Universiteit Leiden

ICT in Business and the Public Sector

Scaling down Doughnut Economics to Sustainable IT at the Organizational Level

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Date: 13/07/2021

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MASTER'S THESIS

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Acknowledgements

Throughout the writing of this thesis, I have received a great deal of support and assistance from a great many people. On the outset of this report, I would like to extend a sincere and heartfelt obligation to everyone who helped me in this endeavor.

I would first like to thank my 1st supervisor, Professor Joost Visser, whose guidance, support and commitment during the course of this study was invaluable. Your insightful feedback, structured approach and our weekly call encouraged me and made my work better.

I would also like to acknowledge my 2nd supervisor, Assistant Professor Christoph Stettina for the help in the thought process as well as his efforts. As well as the Leiden Institute of Advanced Computer Science (LIACS) for giving me the opportunity to learn.

I thank profusely all the colleagues from my internship and the organization that gave me an opportunity to perform my research in the form of that internship; RVO. I would particularly like to single out my company supervisor, Frank Hartkamp for all the invaluable help. Your efforts, spent time and all the opportunities I was given to further my research really helped me perform to the best of my abilities.

I am also grateful to all the people who directly and indirectly helped make this research a success, this includes interviewees and other study participants.

In addition, I would like to thank my family and friends who directly and indirectly helped me during my research. You provided stimulating discussions, unyielding support as well as happy distractions to rest my mind outside of my study.

Last but not least, I owe a great deal of gratitude to my parents for their sympathetic ear, countless spent hours and wise counsel. You are always there for me, and I cannot express enough my unwavering gratitude and conviction that I would not have been here, at this moment, if it were not for your incredible patience and guidance.

Thank you all,

- Wietze Kleisterlee

Abstract

Background

The planet is suffering, ecological boundaries are being crossed, climate change is running rampant and the ocean is acidifying. Humanity needs to become sustainable in order to survive on this planet. However, sustainability is not just about ecology but also about the social element. The thought being that ecological theory can only provide useful answers to the global ecological crisis if it is combined with social theory, and vice versa. This interaction is captured in Kate Raworth's Doughnut Economics model. This doughnut model is designed to collect, aggregate and visualize data on sustainability from an organizational to a national, and global level, thus providing a potentially global mechanism for evaluating sustainability.

Purpose

The purpose of this research is to (1) develop a sustainability assessment model for IT capability of organizations in The Netherlands on the basis of Doughnut Economics; (2) Make the model manageable and executable for IT-organizations (in the form of a survey); (3) Test its usability on a sample of IT-organizations in The Netherlands ; (4) Draw a conclusion about possible usability of the model for research in The Netherlands; (5) Find indications from the test results for possible future research.

Method

The used method is to translate the global Doughnut Economics model (with global descriptions, indicators, requirements, etc.) and amalgamate contiguous theory to an IT-organizational level model that benchmarks IT-organizations to a 5-level maturity model executed by a list of questions that is sent to IT-organizations through a survey. The method used for construction of this method is an iterative process in which sustainability experts are consulted through interviews after having read the research and feedback on the model is collected, processed and implemented.

Results

The results of this research are (1) An assessment model for IT-organizations in The Netherlands was successfully constructed on the basis of the Doughnut Economics model; (2) A questionnaire based on this model was responded to by a sample of IT-organizations in The Netherlands; (3) This provided a detailed picture of the sustainability of the organizations in this sample; (4) A quick breakdown of the overall results of the sample shows IT-organizations within the sample are far along on the social foundations, meaning the average score of IT-organizations on this element is 3.29 out of 5. However, the ecological ceiling is also overshot by far, averaging a score of 2.04 out of 5, whilst IT-organizations are on average well positioned to operate sustainably (average design trait score: 3.50 out of 5). When looking deeper, IT-organizational size come into focus, showing that on average large and very large organizations have a higher sustainability score than smaller organizations.

Conclusions

The conclusion of this research is (1) The assessment model for IT-organizations in The Netherlands lends itself well to analysing and mapping Organizational IT Sustainability; (2) In the sample an average score of 2.04 out of 5 was reached on ecological sustainability amongst IT-organizations. Because 3.0 is the neutral value, they overshoot the ceiling and are not deemed ecologically sustainable on average. An average score of 3.29 out of 5 was reached on social sustainability, this shows ecological sustainability in the sample is lagging behind social sustainability whilst the organizations are on average well positioned to operate sustainably (average design trait score: 3.50 out of 5); (3) Further representative research should come to a snapshot of The Netherlands's IT-sustainability.

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Abbreviations

IT – Information Technology
IS – Information Systems
ICT - Information and Communication Technology
SDG – Sustainable Development Goals
UN – United Nations
GDP – Gross Domestic Product
RVO – Rijksdienst voor Ondernemend Nederland
ICT - Information and Communication Technology
CO_2 - Carbon Dioxide
PPM - Parts Per Million
W - Watt
DU - Dobson Unit
TBD - To be Determined
Km - Kilometer
Ha - Hectare
Yr - Year
Tg - Tera-gram
Kg - Kilogram
E/MSY - Extinction per million species per year
EU - European Union
kcal - Kilocalories
CBS - Centraal Bureau voor de Statistiek (Central Bureau of Statistics)
MSc - Master of Science
BSc - Bachelor of Science
Drs - Doctorandus
C-level - Executive Positions
EHANPP - Embodied Human Appropriation of Net Primary Production

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1 Introduction

1.1 Research Motivation

For decades humanity has stuck its head in the sand: social standards such as having enough food, water and income to have a decent roof above your head whilst feeling free, secure and treated equally didn't (don't) apply to a vast number of people and the ecological crisis was ignored.

This era of willful ignorance and irresponsibility is over, today the public and scientific opinion has largely acknowledged the fact that climate change is real and the realization that there are other planetary boundaries which need to be respected to keep the planet habitable for humanity is growing. We can see that steps have been made to reduce ozone layer damage to a point where it is recovering and we're starting to tackle the climate change problem. The majority of us also feel certain social standards should be met for all of mankind, this is most visible in the Sustainable Development Goals (SDG's) initiated by the United Nations (UN) to which all UN participants agreed.

However, these subjects are often tackled as completely separate, stand-alone issues in an ad-hoc manner whilst both social standards and ecological boundaries are very intertwined concepts that impact and rely on each other massively. This separation leads to a very unstructured and ill-advised approach that also meets challenges due to external (financial) pressures that can be largely attributed to an economical culture that for the last decades has blindly incentivized harmful practices and of which the only goal is to make more profit.

This is where Doughnut Economics comes in, it sees the predicament. Doughnut Economics is a new concept in economic science that understands that ecological theory can only provide useful answers to the global ecological crisis if it is combined with social theory, and vice versa, while also understanding that we need to realize a change in the way of thinking about economic principles. A way of thinking in which the approach to analyzing the success of a community is not a financial indicator (like GDP) but indicators that indicate much more accurately how a community is doing (like social and ecological indicators). It is therefore uniquely qualified to aggregate data on sustainability on a global and national level, thus providing a global mechanism for development towards and evaluating a sustainable economy.

However, this global concept (Doughnut Economics) is limited and, up until now, ill-suited when looking at application to smaller entities than nations or the planet in its entirety. This is due to the fact that this model was made to analyze a planetary problem on a global scale. Which is why this research will translate and downscale this global model to a model that can be used to analyze the sustainability of IT-organizations in The Netherlands on a policy level by means of a self-assessment.

IT currently contributes 3 to 6% to the total of emissions worldwide and is going to hit 14% by 2040 if the trend keeps going, on top of that energy consumption in IT keeps doubling every 4 years and the IT sector employs around 55.3 million people worldwide. As you can see, there is

room for improvement, this research paper and the resulting model will help IT organizations in becoming more sustainable.

1.2 Research Scope

This dissertation was written as part of a graduation internship at Rijksdienst voor Ondernemend Nederland (RVO) and is a cooperation between Leiden University and RVO. This research project focuses primarily on The Netherlands. This means that the majority of the participants and the context of the research are located in The Netherlands.

This research will limit itself to scaling down the Doughnut Economics model (and the Design Traits) to an IT-Organizational (departmental) level (meaning the detail level of knowledge of an IT-manager, possibly aided by Sustainability or Green Office Employee) in organizations which use IT (IT-Organization) within the Netherlands from the 12th of October until the 23rd of July.

Aspects of Doughnut Economics that are not completely worked out (as of the 12th of October 2020), or where indicators and such are missing will not be a part of this research.

1.3 Research Objectives

- Create a model that can determine an organization's level of sustainability in IT based on Doughnut Economics
- Collect data and use this for comparison between model outcome and previous studies.

1.4 Research Question

Can Doughnut Economics be downscaled to IT-organizational size, integrated into organizational level sustainability in a larger sense and used to paint a picture of the organizations' IT-sustainability?

1.5 Research Design

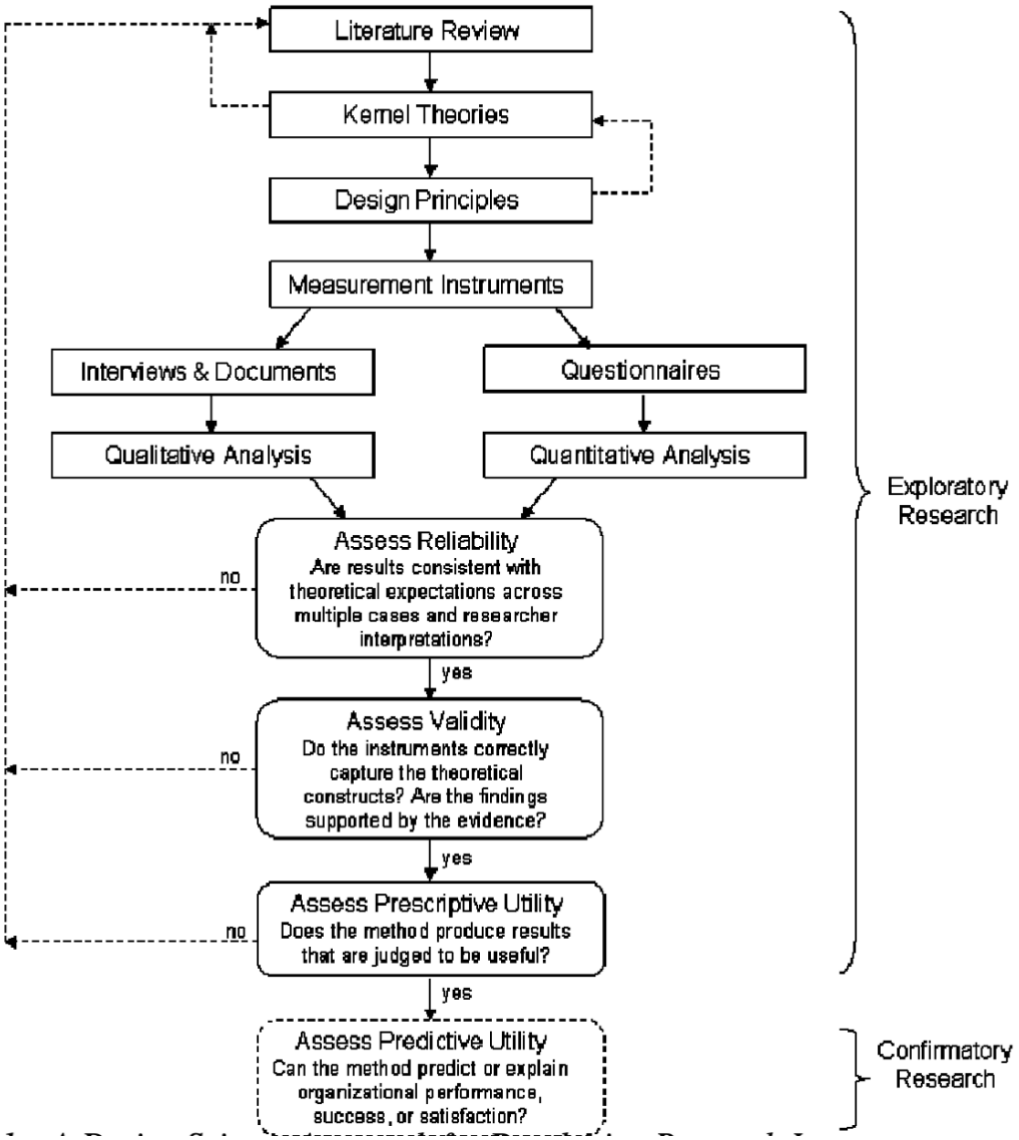


Figure 1 - A Design Science Approach for Developing Research Instruments (McClaren & Buijs, 2011)

The figure above will form a loose basis of how the research will be conducted. First, literature will be reviewed, Kernel (or fundamental) theories will be identified, and definitions will be set. Through these elements a measurement instrument will be constructed which will be evaluated and refined by evaluation and interviews with 5 experts and further documentation/theories.

Eventually the revised model will receive a test-run in which 5 people will be found and asked to fill in the survey to make sure the practicality is secured. After this step the survey is executed by sending a questionnaire to IT-organizations to achieve the goal of answering the main question (researching the applicability of Doughnut Economics on IT-organization's sustainability). More on this in the Methodology chapter (chapter 5).

1.6 Thesis Outline

This chapter shows the outline of the thesis. It aims to enlighten the path traveled to answer the research question.

Chapter 2 is called related work and shows work that is closely related to work in this thesis. Chapter 3 introduces core theories (called kernel theories in the research design) and defines things like sustainability and IT/IS in this research. Chapter 4 shows how the model was constructed by conceptualization theory and displays requirements per maturity level per aspect of Doughnut Economics and the Design Traits as well as sets and defines rules around scoring organizations and sustainability. Chapter 5 shows the used methodologies for research, conducting interviews and the survey. Chapter 6 shows results from the interviews and the survey and breaks these down. Chapter 7 discusses interpretations and implications as well as overarching themes and the limitations of the research. Chapter 8 will draw conclusions based on the results and discussion.

2 Related Works

2.1 Sustainable Development Goals

The Sustainable Development Goals are a call that was adopted by all United Nations member states in 2015 and based on 17 variables that are mostly situated around social sustainability but also include ecological sustainability. (United Nations, 2015) The ecological sustainability element of it is less extensive and more condensed than the social sustainability element.

The 17 variables that are looked at in this programme are:

Figure 2 Sustainable Development Goals (United Nations Development Programme, n.d.)

Multiple targets and indicators were assigned to each of the goals, progress on these targets, indicators and goals is maintained and reported yearly by the UN, giving information per country (where this exists).

This is related work because this is also a policy-level (although at a global/national level) sustainability analytic and reporting mechanism and the social sustainability elements of Doughnut Economics were derived from the social elements of the SDG's. The difference being that this study's model brings a more detailed ecological side to the story, shows the relation between social and ecological sustainability better and downscales both elements to an (IT-)organizational level.

2.2 Circularity R-Ladder

Circularity is an important part of becoming more sustainable, it uses as little as possible new raw materials and instead aims at reusing (or prevent the use of) products, parts and raw materials. It is an economy of closed loops. (Circulair, n.d.) The R-Ladder model enables this by visually representing the steps that enable circularity and have a bigger impact the higher up the ladder you go.

Through time the circularity ladder has had some updates, so multiple variations of the ladder exist. The main difference between these versions is that they either bundle a few steps into one or leave those steps as separate steps in the model. This means there's really not that much of a difference between the different models, they just have different ways to display the information.

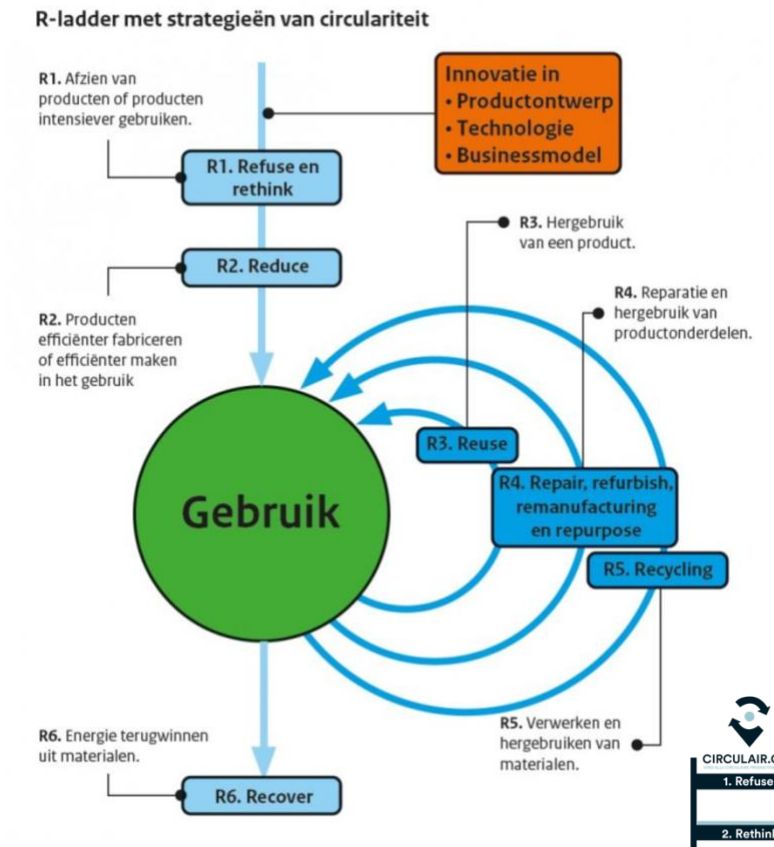


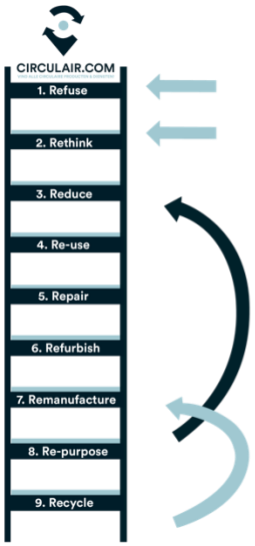
Figure 3 Circularity R-Ladder 6 steps (PBL, 2020)

This version of the ladder, which is used mostly in the public sector, has 6 steps (R's):

1. Refuse and Rethink
2. Reduce;
3. Reuse;
4. Repair, Refurbish, Remanufacture and Repurpose
5. Recycling;
6. Recover.

This version of the ladder has 9 steps (R's):

1. Refuse;
2. Rethink;
3. Reduce;
4. Re-use;
5. Repair;
6. Refurbish;
7. Remanufacture;
8. Re-purpose;
9. Recycle.



Product slimmer gebruiken en maken	1. Refuse	Product overbodig maken door van z'n functie af te zien, of die met een radicaal ander product te leveren.
	2. Rethink	Productgebruik intensiveren (bijvoorbeeld door producten te delen,of multifunctionele producten).
	3. Reduce	Product efficiënter fabriceren door minder grondstoffen en materialen in het product, of het materiaal ervan.
Levensduur verlengen van product en onderdelen	4. Re-use	Hergebruik van afgedankt, nog goed product in dezelfde funcie door een andere gebruiker.
	5. Repair	Reparatie en onderhoud van kapot product voor gebruik in zijn oude functie.
	6. Refurbish	Opknappen van moderniseren van oud product.
	7. Remanufacture	Onderdelen van afgedankt product gebruiken in nieuw product met dezelfde functie.
Nuttig toepassen van materialen	8. Re-purpose	Afgedankt product of onderdelen daarvan gebruiken in nieuw product met andere functie.
	9. Recycle	Materialen verwerken tot dezelfde (hoogwaardige) of mindere (laagwaardige) kwaliteit.

Figure 4 Circularity R-Ladder 9 steps (Circulair, n.d.)

This is related work because this model attempts to bring the concept of circularity within the definition of sustainability. As does the Doughnut Economics model, however this study's model is much more expansive than the R-ladders', which is just one part of the total that is Doughnut Economics.

2.3 CO_2 Performance Ladder

The CO_2 Performance Ladder is a CO_2 management system that consists of 5 levels that can be obtained of which the first 3 are all about managing and reducing CO_2 within the organization. The last 2 levels are obtained when the organization starts looking at and improving their chain/network and industry as well as through living up to and proving the goals the organization has set are met. (Stichting Klimaatvriendelijk Aanbesteden & Ondernemen, n.d.)

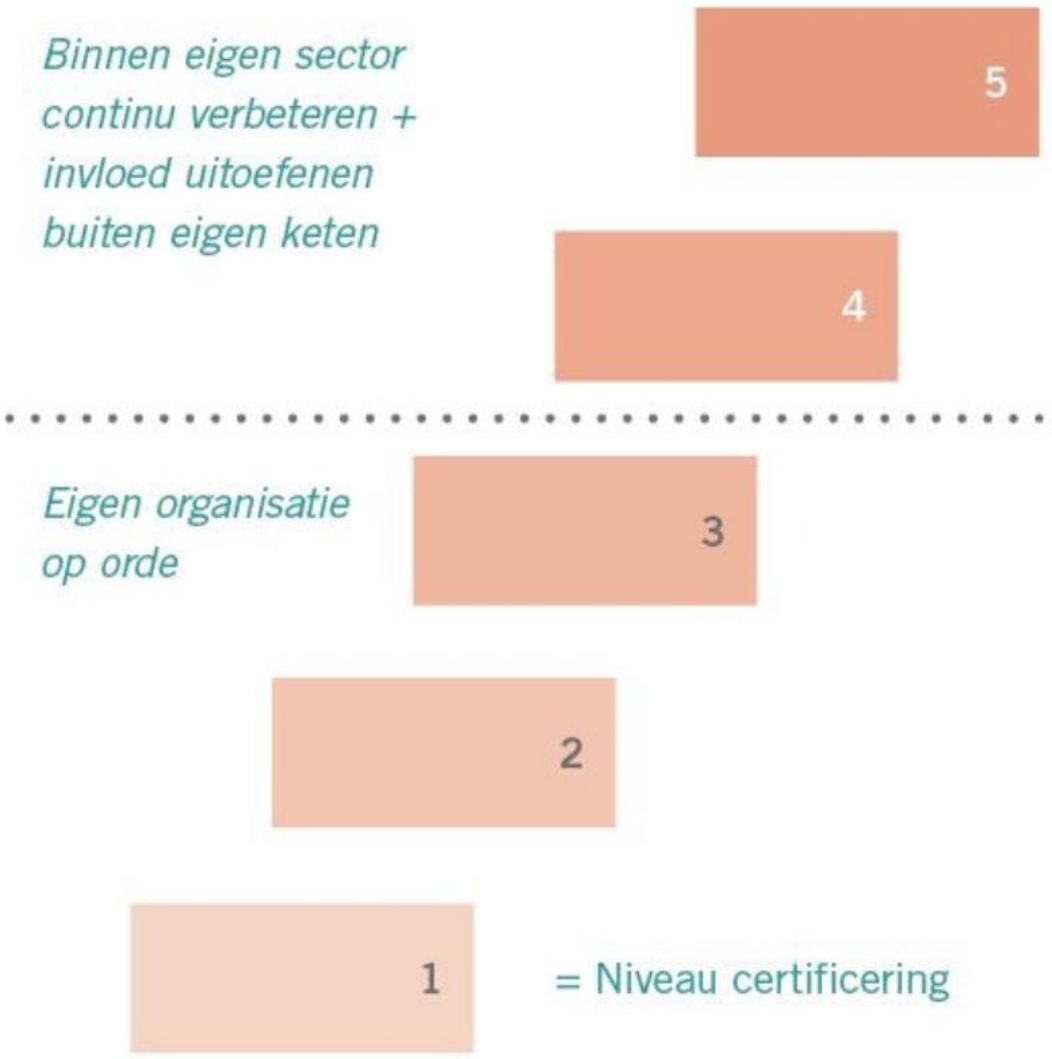


Figure 5 CO_2 Performance Ladder (Stichting Klimaatvriendelijk Aanbesteden & Ondernemen, n.d.)

These previously mentioned goals (requirements) all have to be structured around 4 points of view:

1. Insight
    a. Determining energy flows and the CO_2 footprint
2. Reduction
    a. Developing ambitious goals for CO_2 reduction
3. Transparency
    a. Structural, transparent, fair communication about CO_2-policy
4. Participation
    a. Participation in initiatives in the industry on the area of CO_2 reduction

(Stichting Klimaatvriendelijk Aanbesteden & Ondernemen, n.d.)

This is related work because although it only pertains to a small portion (2 aspects, namely: Climate Change & Ocean Acidification) of this study it does have valuable insights, largely consists of the same subjects, is also divided into 5 levels (as is this study's maturity model) and the higher the level the organization achieves the more it has to go outwards to keep growing within the model.

3 Literature Review

3.1 Definition of sustainability

There are an infinite number of meanings to sustainability:

> The word "sustainability" literally means: "*The quality of being able to continue over a period of time*". (Cambridge Dictionary, 2021)
>
> The term "sustainability" is one that is well known around the globe. However, when this term is considered, the mind often instantaneously goes towards ecological aspects.

3.1.1 Doughnut Economics

This is a normal and valid response when we look at the literal definition of the word because of the time we live in, one with great ecological threats that face the planet and its human civilization, but ecology is not the only element of sustainability. Kate Raworth, a Senior Research Associate at Oxford University's Environmental Change Institute realized this and came up with a model (Doughnut Economics) that unites this previously mentioned ecological element with another element, the social element. The thought being that ecological theory can only provide useful answers to the global ecological crisis if it is combined with social theory, and vice versa.

But more than that, Kate Raworth suggests a change in the way of thinking. One where people, businesses and governments don't measure their success (exclusively) by the growth of GDP/Revenue/Profit (short term financial gain, says nothing about how people are actually doing), but by a set of 21 aspects divided between these 2 elements (Ecological and Social) which together describe whether a community is thriving or whether it is decaying (looking at long term gain for all). The ultimate goal being a score that puts every aspect in the safe and just space for humanity (Raworth, 2017)

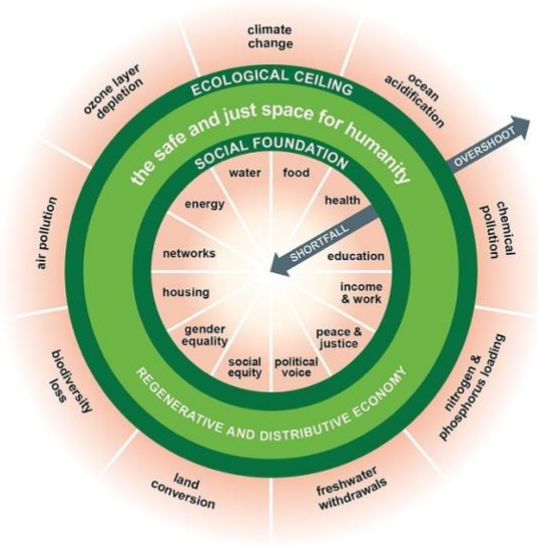


Figure 6 – Doughnut (Raworth, Doughnut Economics, 2020)

3.1.1.1 21 Aspects

The Doughnut is made up out of 21 aspects that together form the ecological ceiling and social foundation, each aspect has its own indicators and thresholds.

3.1.1.1.1 Social Foundation

The 12 social foundation aspects of the total of 21 aspects of Doughnut Economics are based on the social priorities of the Sustainable Development Goals (for more on the SDG's see chapter 2.1) set by the United Nations. (Raworth, 2017) These Sustainable Development Goals are "a shared blueprint for peace and prosperity for people and the planet, now and into the future" which all members of the United Nations have agreed to. (United Nations, 2015)

SOCIAL FOUNDATION	DESCRIPTION	ILLUSTRATIVE INDICATORS
FOOD	Safe, sufficient, nutritious, affordable food for all	Population undernourished
HEALTH	Access to affordable, quality healthcare for all	• Population living in countries with under-five mortality rate exceeding 25 per 1,000 live births • Population living in countries with life expectancy at birth of less than 70 years
EDUCATION	Access to life-long learning for all	• Adult population (aged 15+) who are illiterate • Children aged 12-15 out of school
INCOME & WORK	Decent (safe, meaningful) work and adequate income (fairly paid, living wage) for all	• Population living on less than the international poverty line of $3.10 a day • Proportion of young people (aged 15-24) seeking but not able to find work
PEACE & JUSTICE	Personal security, government accountability, and access to justice for all	• Population living in countries scoring 50 or less out of 100 in the Corruption Perceptions Index • Population living in countries with a homicide rate of 10 or more per 10,000
POLITICAL VOICE	Ensure people have voice in, and influence over, decisions that affect their lives (Democratic institutions, freedom of expression, freedom of association, and a	Population living in countries scoring 0.5 or less out of 1.0 in the Voice and Accountability Index

	free media support inclusive, participatory and representative decision making)	
SOCIAL EQUITY	Ensure equality of opportunity, and reduce income inequality (inequalities are frequently exacerbated by inequalities of race and ethnicity, sexual orientation, religion, age, language, disability and location)	Population living in countries with a Palma ratio of 2 or more (the ratio of the income share of the top 10% of people to that of the bottom 40%)
GENDER EQUALITY	Achieve gender equality and empower all women and girls (Ensuring that women and girls have equal access to education, health care, decent work, and representation in political and economic decision-making processes)	• Representation gap between women and men in national parliaments • Worldwide earnings gap between women and men
HOUSING	Decent, affordable, safe housing for all	Proportion of global urban population living in slum housing in developing countries
NETWORKS	Access to networks - of transport, of communications, and of community support	• Population stating that they are without someone to count on for help in times of trouble • Population without access to the Internet
ENERGY	Access to clean, affordable energy services for all	• Population lacking access to electricity • Population lacking access to clean cooking facilities
WATER & SANITATION	Access to clean water and decent sanitation	• Population without access to improved drinking water • Population without access to improved sanitation

Table 1 Social Foundations (Shorter, Raworth, Fanning, Sanz, & Bianco, 2020)

3.1.1.1.2 Planetary boundaries

The 9 planetary boundaries (aspects) are based on the planetary boundaries set by (Rockström, et al., 2009) in a piece called "Planetary Boundaries: Exploring the Safe Operating Space for Humanity".

EARTH SYSTEM PROCESS	CONTROL VARIABLE	THRESHOLD AVOIDED OR INFLUENCED BY SLOW VARIABLE	PLANETARY BOUNDARY (ZONE OF UNCERTAINTY)	STATE OF KNOWLEDGE
CLIMATE CHANGE	1. Atmospheric CO_2 concentration, ppm; 2. Energy imbalance at Earth's surface, W m-2	• Loss of polar ice sheets. • Regional climate disruptions. • Loss of glacial freshwater supplies. • Weakening of carbon sinks.	• Atmospheric CO_2 concentration: 350 ppm • Energy imbalance: +1 W m-2 (+1.0–+1.5 W m-2)	1. Ample scientific evidence. 2. Multiple sub-system thresholds. 3. Debate on position of boundary.
OCEAN ACIDIFICATION	Carbonate ion concentration, average global surface ocean saturation state with respect to aragonite.	• Conversion of coral reefs to algal-dominated systems. • Regional elimination of some aragonite- and high- magnesium calcite-forming marine biota • Slow variable affecting marine carbon sink.	Sustain ≥80% of the pre-industrial aragonite saturation state of mean surface ocean, including natural diel and seasonal variability (≥80%–≥70%)	1. Geophysical processes well known. 2. Threshold likely. 3. Boundary position uncertain due to unclear ecosystem response.
OZONE LAYER DEPLETION	Stratospheric O_3 concentration, DU	Severe and irreversible UV- B radiation effects on human health and ecosystems	<5% reduction from pre-industrial level of 290 DU (5%–10%)	1. Ample scientific evidence. 2. Threshold well established. 3. Boundary position implicitly agreed and respected.
AIR POLLUTION	Overall particulate concentration in the atmosphere, on a regional basis	• Disruption of monsoon systems. • Human-health effects. • Interacts with climate change and freshwater boundaries.	TBD.	1. Ample scientific evidence. 2. Global threshold behavior unknown. 3. Unable to suggest boundary yet.
NITROGEN & PHOSPHORUS LOADING	Nitrogen: amount of N_2 removed from	Nitrogen: slow variable affecting overall resilience of ecosystems via	Nitrogen: Limit industrial and agricultural fixation of	Nitrogen: 1. Some ecosystem responses known;

	atmosphere for human use, Mt N yr-1 Phosphorus: inflow of phosphorus to ocean, increase compared with natural background weathering	acidification of terrestrial ecosystems and eutrophication of coastal and freshwater systems. Phosphorus: avoid a major oceanic anoxic event (including regional), with impacts on marine ecosystems.	N_2 to 35 Mt N yr^{-1}, which is ~ 25% of the total amount of N_2 fixed per annum naturally by terrestrial ecosystems (25%–35%) Phosphorus: < 10× (10× - 100×)	2. Acts as a slow variable, existence of global thresholds unknown; 3. Boundary position highly uncertain. Phosphorus: 1. Limited knowledge on ecosystem responses; 2. High probability of threshold but timing is very uncertain; 3. Boundary position highly uncertain.
FRESHWATER WITHDRAWALS	Consumptive blue water use, km^3 yr^{-1}	• Could affect regional climate patterns (e.g., monsoon behavior). • Primarily slow variable affecting moisture feedback, biomass production, carbon uptake by terrestrial systems and reducing biodiversity	<4000 km^3 yr^{-1} (4000–6000 km^3 yr^{-1})	1. Scientific evidence of ecosystem response but incomplete and fragmented. 2. Slow variable, regional or subsystem thresholds exist. 3. Proposed boundary value is a global aggregate; spatial distribution determines regional thresholds
LAND CONVERSION	Percentage of global land cover (forests) converted to cropland	• Trigger of irreversible and widespread conversion of biomes to undesired states. • Primarily acts as a slow variable affecting carbon storage and resilience via changes in biodiversity and landscape heterogeneity	≤15% of global ice-free land surface converted to cropland (15%– 20%)	1. Ample scientific evidence of impacts of land-cover change on ecosystems, largely local and regional. 2. Slow variable, global threshold unlikely but regional thresholds likely. 3. Boundary is a global aggregate with high uncertainty, regional distribution of land-system change is critical.

BIODIVERSITY LOSS	Extinction rate, extinctions per million species per year (E/MSY)	• Slow variable affecting ecosystem functioning at continental and ocean basin scales. • Impact on many other boundaries—C storage, freshwater, N and P cycles, land systems. • Massive loss of biodiversity unacceptable for ethical reasons.	<10 E/MSY (10–100 E/MSY)	1. Incomplete knowledge on the role of biodiversity for ecosystem functioning across scales. 2. Thresholds likely at local and regional scales. 3. Boundary position highly uncertain.
CHEMICAL POLLUTION	For example, emissions, concentrations, or effects on ecosystem and Earth System functioning of persistent organic pollutants (POPs), plastics, endocrine disruptors, heavy metals, and nuclear wastes.	• Thresholds leading to unacceptable impacts on human health and ecosystem functioning possible but largely unknown. • May act as a slow variable undermining resilience and increase risk of crossing other thresholds.	TBD	1. Ample scientific evidence on individual chemicals but lacks an aggregate, global-level analysis. 2. Slow variable, large-scale thresholds unknown. 3. Unable to suggest boundary yet.

Table 2 planetary boundaries (Rockström, et al., 2009)

Adding to this knowledge, that was the basis for Doughnut Economics, a few small footnotes need to be added here regarding:

3.1.1.1.2.1 Climate Change

According to a study by the university of Leeds (to which Kate Raworth, the author of Doughnut Economics, sometimes refers) another control variable that can be used for this is 1.6 tons of CO_2 emissions per capita per year (to achieve the Paris Accord goals). (O'Neill D. , Fanning, Lamb, & Steinberger, 2018).

3.1.1.1.2.2 Ozone Layer Depletion

The Montreal Protocol is a protocol that was ratified by all members (nations) of the United Nations in 1987 which regulates the production and use of chemicals that can deplete the ozone layer. (United Nations Environment Programme, n.d.)

3.1.1.1.2.3 Phosphorus and Nitrogen Loading

According to a study by the university of Leeds (to which Kate Raworth, the author of Doughnut Economics, sometimes refers) another control variable that can be used for Phosphorus loading is 0.9kg per year per capita. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

According to a study by the university of Leeds (to which Kate Raworth, the author of Doughnut Economics, sometimes refers) another control variable that can be used for Nitrogen loading is 8.9kg per year per capita. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

3.1.2 Design Traits

As mentioned, (chapter 3.1.1) to be sustainable the previously mentioned and elaborated 21 aspects need to be balanced in such a way they fall in the "safe and just space for humanity". But Marjorie Kelly states that in order for an organization to be able to achieve this balance (achieving mission zero or becoming generative) there is a need for alignment of organizational elements called design traits, these traits are: Purpose, Governance, Networks, Ownership and Finance.

These design traits are all interdependent and if one of them changes, all often change. The outcome and alignment of these design traits together show the likeliness of an organization being sustainable and sustaining that sustainability. (Kelly, 2012) (Kelly, 2013)

3.1.2.1 Purpose

The purpose of an organization is often made available through mission and vision statements, and it shows in how these are translated into the organization.
This trait is of great importance, when organizations do not want to contribute to the sustainability of its practices (and in doing so create a positive effect on not just the planet (ecological) but also its inhabitants (social)) it is highly unlikely they will.

Here, a difference is made between a *narrow* and a *living* purpose:

- A *narrow* purpose is one that aims at just financial success
    - Example: "We aim to be the biggest computer manufacturer"
- A *living* purpose is one that aims at adding something to the world and its inhabitants
    - Example: "We aim to bring sustainability to computer manufacturing"

(Kelly, n.d.)

3.1.2.2 Governance

The governance of an organization is often visible through the metrics it uses to assess its performance and that of those who work there.
This is an important trait because it shows the difference between an organization with a "soul", meaning it won't (knowingly) operate against the values of those in charge. And those organizations without a "soul" which are only governed by short-term-success.

Here, a difference is made between a *tight* and a *mission* focus:

- A *tight* focus on governance is one that is bent on achieving short-term, financial success and is often controlled by capital markets
    - Example: Weekly reporting focus on turnover and profit
- A *mission* focus on governance is one that is focused on achieving long-term transformative action and is controlled by someone dedicated to a social mission

(Kelly, n.d.)

In this research this includes the traditional IT-governance focus on speed, agility and continuity (*tight* focus) versus an IT-governance focus in which sustainability aspects are as or more important (*mission* focus).

3.1.2.3 Networks

The network(s) of an organization are visible by ascertaining a list of customers, suppliers and partners. It is important they know the values and purpose of the organization and are aligned with those as they influence how the organization does its business (and vice versa).

If there is no alignment, how can the organization turn this around to achieve alignment without compromising its own values? (Kelly, n.d.)

3.1.2.4 Ownership

Ownership is a large indication for how an organization is financed (which is the final trait that will be treated after this) which is an important factor in establishing whether an organization can actually live up to the purpose it wants to.

Here, we distinguish between *absentee* and *rooted* ownership:

- *Absentee* ownership is ownership that is disconnected from the life of the organization
    - Example: Owned by the Stock Market (more share-traders, not shareholders)
- *Rooted* ownership is ownership that is in human hands
    - Example: Owned by its employees, a founding family, values-based investors

(Kelly, n.d.)

3.1.2.5 Finance

Who finances/financed the organization? This is important to know because it allows for the knowledge whether these financers have a commitment to ecological and social progress (with a fair, but ultimately smaller financial return) or whether they are focused on quick and high returns.

Here, a distinction between *share traders* and *shareholders* is made:

- A *share trader is* focused on quick and high returns
- A *shareholder* has a commitment to ecological and social progress (with a fair, but ultimately smaller financial return)

(Kelly, n.d.)

3.1.3 Definition of sustainability used in this research

Sustainability is enabling individuals, groups, organizations, nations and indeed the entirety of humankind to thrive through respecting and adhering to the 12 ecological (ceiling) and 9 social (foundation) aspects of the Doughnut Economics model and aligning the 5 organizational design traits for that purpose.

3.2 Definition of Information Systems (IS) and Information Technology (IT)

Arguments about the definition of information systems (IS) date back over 40 years, and in that time many experts, writers and/or academics have debated and written about elements of the identity of information systems. But first, let's take a look at the difference between Information Technology and Information Systems and which is the term that covers the field this research is looking into.

3.2.1 Information Systems (IS)

Weber tried to define information systems as to differentiate it from other fields and did so by stating that the information system is: "*an object that can be studied in its own right, independently of the way it is deployed in its organizational and social context and the technology used to implement it.*"

Which means that this definition does not concern itself with management, specific hard and software types, characteristics of users, implementation, use and/or power distribution in organizations. It purely focusses on an information system as an independent artifact. (Weber & Wand, 1990)

Yet, according to Davis, an organization's information systems are made up out of its hard- and software, meaning:

- Information Technology (IT) Infrastructure;
- Data;
- Applications.

But adding to that, the term information systems also entails the management in charge of and personnel executing: Planning, Designing, Developing, Implementing, Operating and providing information systems. Meaning IS consists of technical elements and connected activities attributed to humans within an organization that include:

- Strategic planning for information and communication systems
    - Co-alignment of organizational strategy with information and communication system strategy
- Management of the information system function
- Information systems personnel
- System development processes
    - Unique methods and tools are applied, and the information systems change organizations, reflecting management decisions about both internal and external interaction which can lead to considerable organizational changes
- Evaluation.

(Davis, 2000)

3.2.2 Difference between Information Systems (IS) and Information Technology (IT)

Information Systems is an umbrella term that encompasses systems, people and processes designed to create, store, manipulate, distribute and disseminate information. The field of information systems bridges business and computer science.

Many people use IT and IS as an interchangeable term, but IT is actually a subset of IS. The confusion likely arrives through the thought that all IS uses IT and the 2 are therefore interchangeable, this is a false assumption as IT deals with the technology in the systems itself. IS can be about something as complicated as management or as simple as pen and paper.

The difference being that IS encompasses technology, people, and processes involved with information and IT involves the design and implementation of information/data within an information system. (Florida Tech, n.d.)

3.2.3 Definition of IS/IT used in this research

Keeping the reason for this research in mind (pertaining to IT departments and strategies of Organizations) and to facilitate clarity and avoid confusion or misdirection, this research will use the following definition of IS/IT:

> *Information Systems reliant on and/or working in cooperation with computers, IT infrastructure or the digital spectrum and its data & applications and any management, personnel and/or organizational structure that comes with it within an organization.*

An example of this is: The IT-organization of an organization including its management, strategies, personnel, data, hard- and software.

3.3 Definition of Organization

Another good example of a word with an infinite number of meanings is: “Organization”.

The word literally means: “*A group of people who work together in an organized way for a shared purpose*”. (Camebridge Dictionary, 2021)

This is a very wide and quite unspecified definition, that means that every cooperation of people who work towards a purpose is an organization. That means the IT-department is in itself an organization (within another organization), in practice however, the term is often used as a synonym for a company, firm or concern.

The definition that will be used here is both (since the word and the term are, in the eyes of this research, complimentary). This means however that more specification is needed when talking about different kinds of organizations. Which is why in the continuation of this research the type of organization will always be specified in which an organization is just that, the entire organization and the IT-Organization is the organization (Department) around the delivery of IT/IS (not an organization that sells/maintains/delivers IT as its main form of income).

3.4 Global Overview of Sustainability

When there is talk of sustainability, this is often summarized into climate change. And although climate change is one of the most visible aspects of ecological sustainability it is not the only aspect. As is previously stated there are 9 ecological aspects and 12 social aspects to sustainability. An overview of the current state of affairs (pertaining to these 21 aspects) can be found in figure 7 (below).

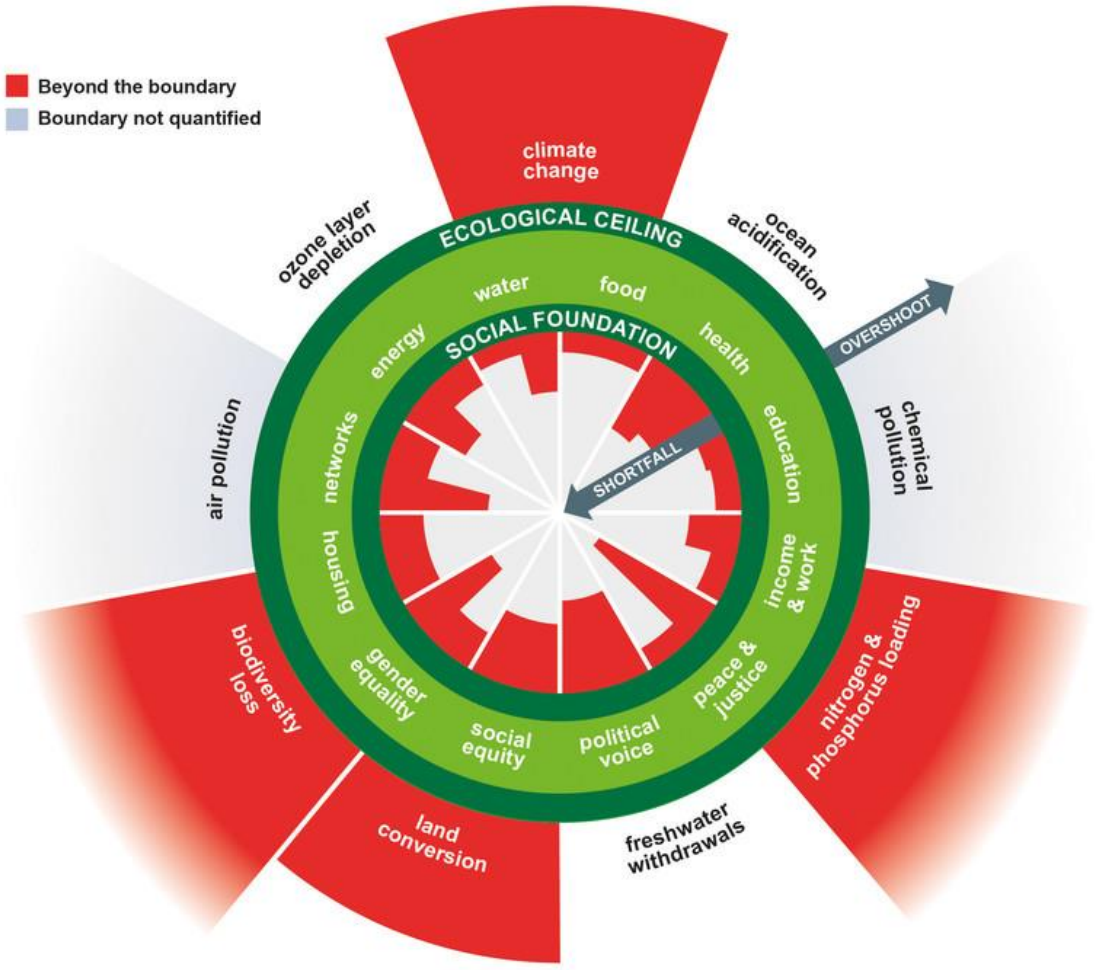


Figure 7 Doughnut filled in (Raworth, 2017)

3.4.1 Global Overview of Ecological Sustainability

The planet is changing, this has become apparent and is dangerous for its inhabitants. Glaciers are melting due to climate change and coral reaves are shrinking and disappearing due to ocean acidification and changing heat conditions. (Flannery, 2015)

On top of this monsoon systems are being disrupted by air pollution and freshwater withdrawals, Phosphorus buildup is leading up to a major oceanic anoxic event, land is being deforested at an unprecedented rate, leading to carbon storage and overall resilience. (Rockström, et al., 2009)

Luckily there is also a little good news on this front, the Ozone layer, which had been depleted is starting to recover after the 1987 Montreal Protocol banned all chlorofluorocarbons and Halons gasses which up to that point were prevalent in aerosol sprays and as coolant in refrigerators (Nunez, 2019). Later it was found out that bromine and hydrochlorofluorocarbons also added to ozone depletion and these are also being phased out. (NASA, 2004) A prediction that the ozone layer would heal completely in the Northern Hemisphere by the 2030s, followed by the Southern Hemisphere in the 2050s and polar regions by 2060 has been made. (Nunez, 2019)

The current state of affairs pertaining to this ceiling can be found in figure 8 (below).

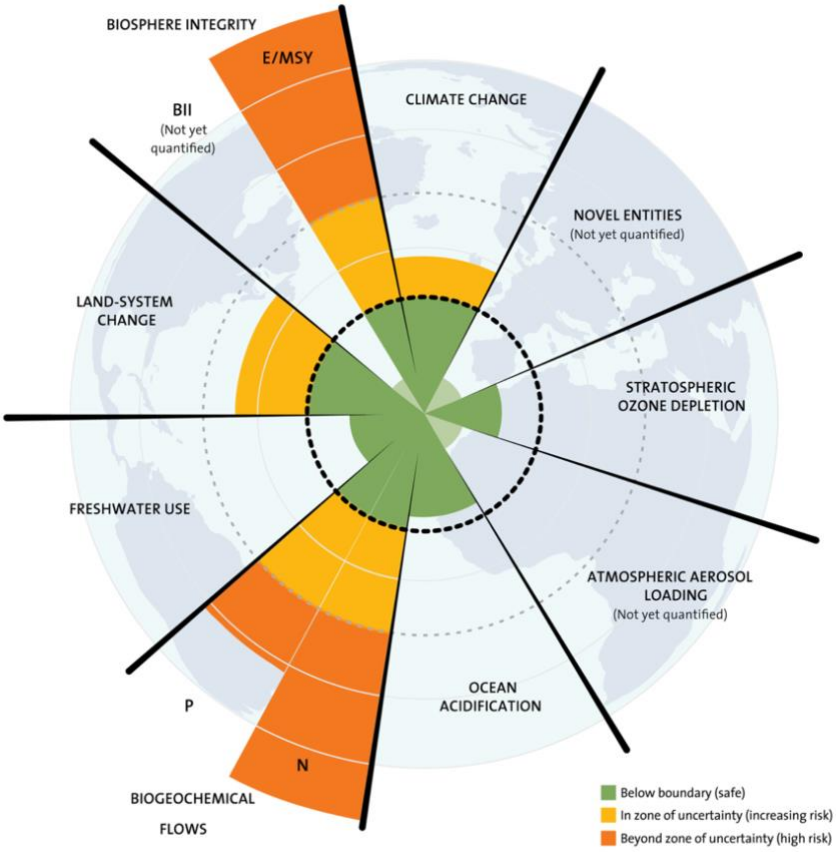


Figure 8 Planetary boundaries and how humanity is doing (Lokrantz & Azote, n.d.) based on (Rockström, et al., 2009)

With new incentives, agreements, willingness and the eyes of the world fixed on ecological sustainability there seems to at least be hope for the future, but history has taught us to be skeptical. In the end, only time will tell. For the full global overview of Ecological Sustainability see appendix I.

3.4.2 Global Overview of Social Sustainability

While the planet is changing, and humanity is struggling to find a way to achieve getting below the ecological ceiling another important aspect of sustainability is also making headway: the social aspect of sustainability.

In India, with its population of 1.3 billion people, 189.2 million people are undernourished (Food and Agriculture Organization of the United Nations, 2020), in South Soudan the perceived level of public sector corruption is running rampant (United Nations, 2020) and in the Central African Republic 829 children died per 100.000 births (data from 2017) which is one of the highest maternal mortality rates in the world. (United Nations, 2017)

An important step towards improvement is the 2030 agenda for sustainable development, which was adopted by all United Nations members in 2015. All of these United Nations members (nations) agreed to set a goal at bettering their nation's standing on 17 goals, called the Sustainable Development Goals (SDG's), most of these goals are a reflection of social sustainability (and some of ecological sustainability). (United Nations, 2015)

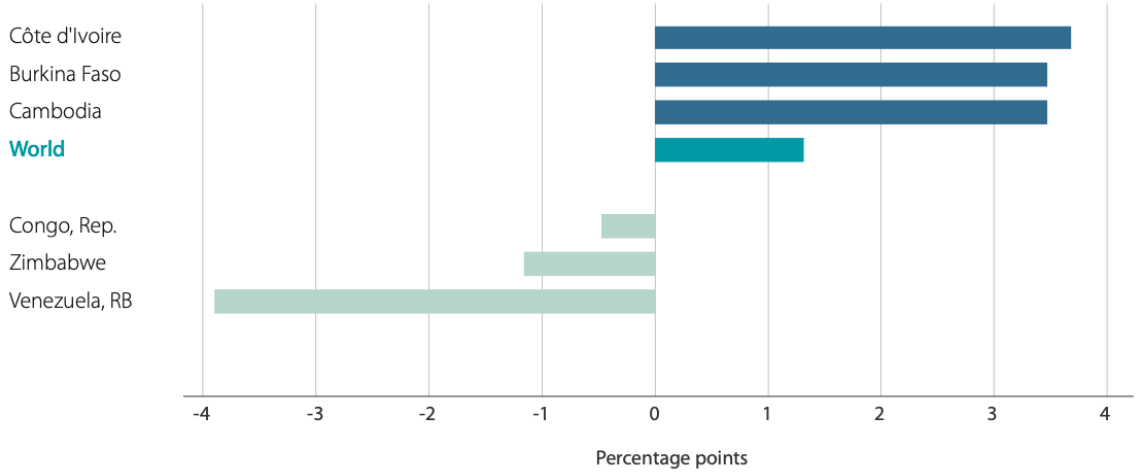


Figure 9 Countries whose SDG Index score has improved or decreased the most since 2015 (United Nations, 2020)

With a strong focus on social sustainability the SDG's definitely help the world along towards a more socially sustainable future. However, things are moving slowly, new models attracting attention and continuous reporting helps this along but is not a guaranty for success. Hope is strong, but once more, only time will tell what reality brings. For the full global overview of Social Sustainability see appendix II.

3.5 Categorization of organizational responses - Corporate to Do List

The Corporate to Do List originates from a wide array of observations and experiences that came from presenting the concept of Doughnut Economics to fortune 500 and community enterprises and is the categorizing of likeminded responses to a list of 5 basic responses:

1. Do Nothing
2. Do What Pays
3. Do Your Fair Share
4. Do Mission Zero
5. Do Generative / Distributive.

(Raworth, 2018)

3.5.1 Do Nothing

This category encompasses (IT-)organizations that see no need to change their business model because the culture within these (IT-)organizations is one of delivering strong returns today. They feel delivering maximal financial value to their shareholders in the short term is the priority, even if that means being only 'mostly' legal, fines resulting from this are considered as a cost of business and often pre-calculated.

With many (IT-)organizations now understanding that their product supply chains are at risk due to environmental and social changes, this is no-longer the most common strategy. (Raworth, 2018)

3.5.2 Do What Pays

This category encompasses (IT-)organizations that see a need for change and do so by adopting eco-efficiency and social measures, they do this to:

- Boost the brand's popularity
- Greenwashing
- Cut costs.

(IT-)Organizations within this category often only apply these eco-efficiency and social measures in a few fields to seem involved.

Another hallmark of this category is the use of green product branding, meaning these (IT-)organizations want to motivate consumers by marketing their measures/products. What follows is an array of benchmarks between (IT-)organizations in the same industry, but "doing more than the competition" does not mean enough is actually done to reach any form of real sustainability. (Raworth, 2018)

3.5.3 Do Your Fair Share

This category encompasses (IT-)organizations who do their fair share. They acknowledge the scale-change that is needed and often contribute to total reduction in greenhouse gas emissions,

fertilizer use or water withdrawals. These (IT-)organizations are however not making it their mission to be a frontrunner, a figurehead, to lead the change but only partially commit.

On top of the previously mentioned there is also a dilemma here, and that is: *What is your fair share?* Ask a person and their answer is likely to be completely different from your own. These companies often don't "do their fair share" but "take their fair share" meaning they are still caught in the degenerative, linear way of thinking: "How much CO_2 can we emit?" which reinforces a view that the right to pollute is a valuable commodity which again leads to the risk of transgressing ecological and social boundaries in the process. (Raworth, 2018)

3.5.4 Do Mission Zero

This category encompasses (IT-)organizations who do no harm, meaning they do no harm in making products, services and buildings and they keep this in mind as early as the design phase.

An example is: buildings which compensate the energy they use by generating it via solar and wind techniques.

These kinds of (IT-)organizations are often very far along in terms of efficiency of their processes so they have very little waste and can thus produce very efficiently and find ways to compensate for that. This is good; however, resource efficiency is not enough, architect and designer William McDonough put it the following way: "Being less bad is not being good, it is being bad, just less so." (Raworth, 2018)

3.5.5 Do Generative / Distributive

This category encompasses (IT-)organizations who are generative by design, which are willing and able to give back to the living systems they and all of humanity with them are a part of. It is a mindset in which is recognized there is a responsibility to leave the world a better place than when we got there.

Why aim at being less bad? Why not replenish instead of slowing the depletion? Why stop at a factory that produces as much clean water as it uses? Why not see if more can be produced?

These (IT-)organizations are there to do good for the planet, its biospheres of plants and creatures, including humanity. (Raworth, 2018)

3.6 Business Sustainability Maturity Model

The business sustainability maturity model is “an innovative solution to support companies move towards sustainable development”. (Cagnin, Loveridge, & Butler, 2005)

3.6.1 How it works

The model is based on the capability maturity model (Paulk, Curtis, Chrissis, & Weber, 1993) and allows for the assessment of the maturity level of organizations regarding sustainability.

3.6.1.1 7 elements of value

It does this by analyzing 7 different elements which are based on the value activities of the sustainability net (which is a sustainability-related redefinition of the term value net, which itself is an evolution of Porter’s value chain (Porter, 1985). In order to deliver the wealth of social and environmental benefits to shareholders and stakeholders within society the concept “sustainability net” was invented), these elements are:

- Strategy;
- Partnerships;
- Motivation;
- Competences;
- Communication;
- Technology;
- Operations.

3.6.1.2 5 levels of maturity

The previously mentioned 7 elements are analyzed and placed into 5 different levels of maturity:

- Ad Hoc
- Planned in Isolation
- Managed with no Integration
- Excellence at Corporate Level
- High Performance Sustainability Net.

3.6.1.3 Requirements

For each of the previously mentioned elements different requirements apply per maturity level. Meaning that the requirements for achieving a less mature status are different (and easier to achieve) than requirements for a higher maturity status.

4 Model Design

This chapter shows how the information and knowledge gathered in the previous chapter is made into a single model and adds little pieces of information that have to do with translation of the global (worldwide) model to something that can be introduced in an IT-organization.

4.1 Translation and amalgamation of global model to IT-organizational level model

The Business Sustainability Maturity Model described in the previous chapter (chapter 3.6) led to the inspiration to combine the aspects of Doughnut Economics and the design traits and classify them (as elements) in the form of a maturity model in which the maturity levels are based on the Corporate to Do List (chapter 3.5). For each of the intersections a requirement or a number of requirements is set.

But before this can be done, first the requirements, rules, control variables, thresholds and statements meant for a global model have to be translated and remolded to requirements, rules, variables, thresholds and statements meant for something less global, smaller and more defined: IT-organizations as well as the need to be made suitable to fit in a 5-level scale.

When reading, it is noticeable that the higher the maturity level the higher the complexity, the amount of organization & reporting, the amount of outward (locally and globally) thinking and the number of requirements becomes. Circularity and the need to account for sustainability increases with every jump in maturity level and is essential to climb those maturity levels.

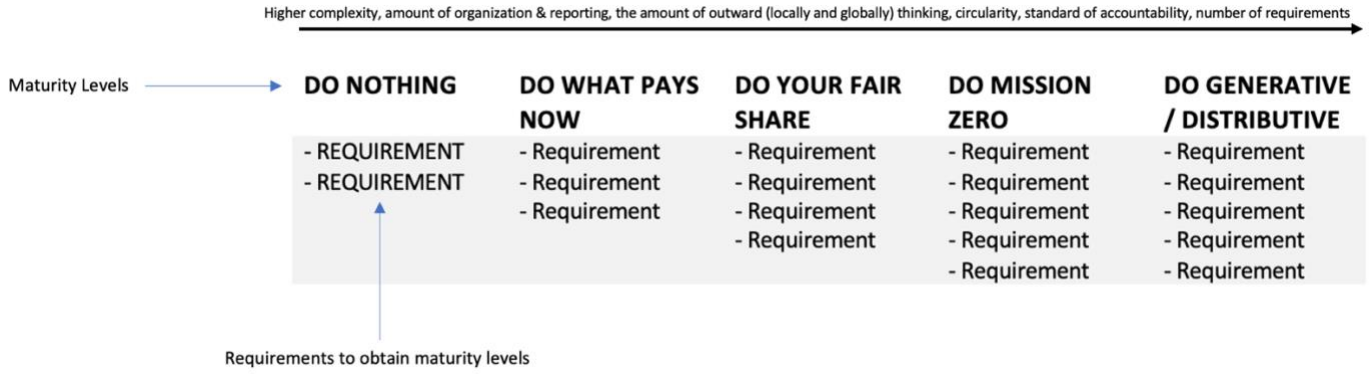


Figure 10 Schematic Representation Maturity Model

*Note: Where the term “Employee” is used in requirements or during the explanation of the model, an educational institution (like a university) can include students in that term (because they are spending time and using the institution’s resources whilst a lot of students do not work).

4.1.1 Design Traits

Although this research is geared towards IT-sustainability the design traits are geared towards evaluating an organization in its entirety to evaluate whether or not the (IT-)organization can actually be or become sustainable. Meaning the overall goal of the five Design Traits is to establish whether an (IT-)organization can be sustainable or whether it needs to change its fundamentals (Design Traits).

4.1.1.1 Purpose

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
Has a narrow, purely financial purpose	Has a narrow, mostly financial purpose paired with some (easy to achieve) social/ecological goals	Has a living purpose, but is still caught in degenerative* thinking	Has a living purpose with a clear non-financial "bigger than just us" goal where the net total emissions equal zero.	Has a living purpose in which the organization wants to add (social/ecological) benefits to society by being generative and distributive

Table 3 Model, Design Trait - Purpose

*Degenerative thinking means an organization is still thinking in terms of "how can we make things less bad" instead of "how can we add benefits".

4.1.1.2 Governance

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
Has a tight, purely financial focus with metrics aimed at turnover and market share	Has a tight focus, with metrics aimed at turnover and market share and smaller sustainability initiatives that cut costs (be it directly or indirectly, avoiding fines/boosting sales etc)	Has a mission focus with a mix of metrics aimed to achieve (some) minimal sustainability goals set by governments and short-term financial gain	Has a mission focus with metrics for long-term action that enable zero-emissions, no degradation of the social foundation and is delegated to those on a social mission	Has a mission focus, with no/less (or less emphasis on) metrics aimed at short-term financial gain but long-term transformative, generative and distributive action and is controlled by those on a social mission

Table 4 Model, Design Trait - Governance

4.1.1.3 Networks

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
Network of customers, suppliers and partners that is purely there for short-term financial gain and the organization has no interest in changing this	Network of customers, suppliers and partners that is there for short-term financial gain but also includes a small number (relative to the total amount) of sustainable organizations, organization has no interest in changing this.	Network of customers, suppliers and partners that is diverse and know the values and purpose of the organization, organization is actively involved in keeping network diverse (slight sustainability purpose/value integration)	Network of customers, suppliers and partners that knows of with the values and purpose of the organization and is aimed towards a zero emission and zero social foundation degradation future (partial sustainability purpose/value integration)	Network of customers, suppliers and partners that knows of and agrees with the values and purpose of the organization and is aimed and actively contributes towards a generative future (total sustainability purpose/value integration)

Table 5 Model, Design Trait - Networks

4.1.1.4 Ownership

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
Organization has absentee ownership which feels it has no line it won't cross for the bottom line	Organization has absentee ownership which decides to do "some of the right things, for the wrong reasons", short-term financial gain	Organization can have absentee or rooted ownership that is willing to match national goals	Organization has rooted ownership that commits to net zero emissions	Organization has rooted ownership that commits to being generative (looking for ways to not just "be less bad" but actually be good) and distributive

Table 6 Model, Design Trait - Ownership

4.1.1.5 Finance

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
Organization is financed by share traders wanting only fast financial returns and don't care how they come by those (willing to incur fines if that leads to financial gains)	Organization is financed by share traders wanting fast financial returns but are willing to invest in sustainability if that increases their personal gain	Organization can be financed by both share traders and shareholders who commit to minimal goals set by regulation	Organization is financed by value driven shareholders who have a shared value towards ecological and social mission zero (no net emissions, no social foundation deterioration)	Organization is financed by value driven shareholders who have a shared value towards ecological and social generative (more than just "being less/not bad" but wanting to add to the world) sustainability

Table 7 Model, Design Trait - Finance

4.1.2 Social Foundation

Social Foundations are in some cases described on an organizational (not an IT-organizational) level because these are often agreed upon and recorded organization-wide, in collective labor agreements and / or the law or is just too wide a subject for just the IT-organization.

4.1.2.1 Food

Food in a global sense is (as stated in chapter 3.1.1.1.1) about safe, sufficient, nutritious, affordable food for all. When translated to an organizational level this comes down to safe, sufficient, nutritious, affordable food for those who are employed by the organization (and when being distributive that also means those in the (local) community).

Sufficient/nutritious: According to a study by the university of Leeds, the social nutrition threshold is 2700 kcal per capita, per day. This leads to the following reasoning: An Employee in The Netherlands spends about 6.2 hours per day (CBS, 2020) or 18% of his or her week at work, meaning that at least 2700*0.18 = 486 kcal in food needs to be made available per employee per day to provide enough nourishment. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Safe: In The Netherlands there is a commodities law (Warenwet) in which food safety is anchored which is derived from EU guidelines and laws. Safe means complying with these laws. (Voedingscentrum, n.d.)

Affordable: Affordability has to do with price relative to income, literally: the state of being cheap enough for people to be able to buy. (Camebridge Dictionary, 2021)

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The organization does not provide safe, nutritious, affordable food, a place to consume it or does not locate itself near a place where it can be purchased against a reasonable price	1. The organization locates itself near a source where safe, nutritious, food can be purchased but does not concern itself with affordability. 2. Or motivation for providing safe, nutritious, affordable food is purely organizational gain (like attracting talent or lowering absenteeism).	The organization provides safe, nutritious, affordable food or locates itself near a source where safe, nutritious, affordable food can be purchased against a reasonable price and provides a pleasant place to consume it to commit to national targets	The organization has its own food policy that is aimed at: 1. Providing all its employees with safe, nutritious, affordable food 2. Sourcing food locally as much as possible 3. A pleasant place to consume it 4. Come to net zero emissions in the entire food chain 5. Periodically analyze the situation to look for improvements	The organization has its own food policy that is aimed at: 1. Providing its employees and the (local) community with safe, nutritious, affordable food and 2. Sourcing food locally as much as possible 3. Waste disposal is circular (composting etc.) 4. A pleasant place to consume it 5. Take away harmful emissions and add in positive ways to the environment when looking at the entire food chain 6. (Periodically) analyze the situation to look for improvements 7. Growing food (through, for example; Urban Farming)

Table 8 Model, Social Foundation - Food

4.1.2.2 Health

In The Netherlands, there is a national, mandatory obligation for each individual to purchase healthcare insurance. (Rijksoverheid, n.d.) Because of this, The Netherlands as a whole (including the organizations within it already) provides access to affordable, quality healthcare and thus meets the standard as far as health goes. As a consequence, the first (lowest) 2 levels of maturity ('Do Nothing' and 'Do what Pays Now') are impossible to achieve.

Organizations can however choose to invest in the health of their employees more so than required by law, all these factors combined mean that scaling down from a global model to an organizational model adds up to additional benefits that increase health that an organization delivers.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
		The organization 1. Follows the law 2. Has additional health measures in place for senior employees (such as: a gym, gym membership (compensation), counselors and/or collective healthcare insurance)	The organization has an 'additional health policy' that is aimed at: 1. Providing additional healthcare facilities / measures, such as: a. a gym b. gym membership (compensation) c. counselors and/or d. collective healthcare insurance) to all employees 2. Analyzing the impact of its actions (and what it asks of its own employees) on the health of its own employees and coming to net zero harm towards these employees. 3. Coming to net zero emissions in the entire health(care) chain	The organization has an 'additional health policy' that is aimed at: 1. Providing additional healthcare facilities / measures such as a. a gym b. gym membership (compensation) c. counselors and/or d. collective healthcare insurance) to all employees and the (local) community 2. Analyzing the impact of its actions (and what it asks of its own employees) on the health of its own employees and the (local) community and instead of "doing no harm" making their health better than it was as a result 3. Incentivizes unhealthy employees and (local) community members to make use of facilities/measures 4. Take away more harmful emissions than are expelled into the environment when looking at the entire health(care) chain

Table 9 Model, Social Foundation - Health

4.1.2.3 Education

Education on a global scale has to do with (as stated in chapter 3.1.1.1.1) access to life-long learning for all and according to research by the university of Leeds about the enrollment rate in secondary school (so educational rate). (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

In The Netherlands all children from 5 to 16 are required by law to attend primary and secondary school and in a large percentage of cases also secondary vocational education (if one did not obtain a starting qualification by the time one reaches the age of 16 one has to study until one is at least 18), so the educational rate is high and thus not really a factor here. (Rijksoverheid, n.d.)

These factors combined mean that translation from global model to organizational model has to do with providing life-long learning on an organizational scale.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not provide any type of education	The IT-organization provides (partial funding for) education to employees when it needs (or anticipates the need for) new expertise	The IT-organization provides (funding for) education to employees who ask for it	The IT-organization has its own education policy aimed at: 1. Providing (funding for) education and educational infrastructure for all employees designed around their personal advancement wishes and timing 2. Analyzing the impact of its actions (and what it asks of its own employees) on the education of its own employees and coming to at least net zero education deterioration towards these employees 3. Coming to net zero emissions in the entire education chain	The IT-organization has its own education policy aimed at: 1. Providing education and educational infrastructure for all employees designed around their personal advancement wishes and timing 2. Providing education and/or educational infrastructure for (local) community and network 3. Analyzing the impact of its actions (and what it asks of its own employees) on the education of its own employees and the (local) community and adding more education to both the employees as well as the (local) community. 4. Take away more harmful emissions than are expelled into the environment when looking at the entire education chain

Table 10 Model, Social Foundation - Education

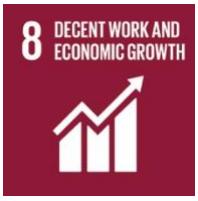
4.1.2.4 Income & Work

Income & Work on a global scale (as stated in the literature review) has to do with decent (safe, meaningful) work and adequate income (fairy paid, living wage) for all.

In The Netherlands there is a national mandatory obligation to pay a minimum wage (Rijksoverheid, n.d.), because of this it is impossible for organizations to pay below that minimum wage, which is a living wage (meaning it provides enough financial room to live). As a consequence, the first (lowest) 2 levels of maturity ('Do Nothing' and 'Do what Pays Now') are impossible to achieve in The Netherlands.

Translating the global scale to an organizational one has to do with enabling people to live their lives through fairly paid, living wage & work.

Living wage: This has to do with the connection between price of goods and the salary received, literally: Enough money to buy the things that are necessary in order to live, such as food and clothes. (Camebridge Dictionary, 2021)



Fairly paid: This has to do with the salary an individual receives for the work he does in relation to another individual. Forbes states an organization that communicates clearly about why you are being paid what you are being paid, "If the organization's pay structure is clearly communicated and well-designed". (Forbes, n.d.)

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
		The IT-organization pays a living, minimum wage that is applicable to all employees and allows the individual to (financially) live their life.	The IT-organization: 1. Pays at least a living, minimum wage that is applicable to all employees and allows the individual to (financially / socially) live their life 2. Has a written structure to indicate growth in: a. Work status b. Work responsibility c. Wage increase 3. Analyses the impact of its actions on the income & work of its own employees and comes to at least net zero income and work deterioration towards these employees	The IT-organization: 1. Pays at least a living, minimum wage that is applicable to all employees and allows the individual to (financially / socially) live their life 2. Deliberates with its employees, creating insight in their situation and needs and uses that information as a factor on which wage is based 3. Works with underprivileged people and gives these people a chance within the organization 4. Analyses the impact of its actions on income & work both locally and globally and actively contributes to an income and work improvement on both counts

Table 11 Model, Social Foundation - Income & Work

4.1.2.5 Peace & Justice

To understand exactly how to translate this from such a large, global perspective to a smaller organizational perspective, first the two concepts of peace and justice need to be defined.

Peace: is about freedom from disturbance and threat of (physical) violence, literally: Freedom from war and violence, especially when people live and work together happily without disagreements. (Camebridge Dictionary, 2021)

Justice: is about how disputes are arbitrated and about equal treatment (that was agreed upon beforehand) in equal situations, literally: Fairness in the way people are dealt with. (Camebridge Dictionary, 2021)

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
1. The IT-organization does not provide any type of peace and justice 2. Employees feel unsafe 3. Employees feel unfairly treated when it comes to disputes	1. The IT-organization provides counsellors to mediate, the goal is to create organizational value (for example keep absenteeism in check) 2. Employees feel slightly safe 3. Employees feel they are only treated fairly sometimes when it comes to disputes	1. The IT-organization provides counsellors to mediate 2. The IT-organization provides a complaint procedure & complaints committee 3. The organization is GDPR compliant 4. Employees feel safe 5. Employees feel they are treated fairly in general when it comes to disputes	1. The IT-organization provides counsellors to mediate 2. The IT-organization provides a complaint procedure & complaints committee 3. The organization is GDPR compliant 4. The IT-organization analyses the impact of its actions on the Peace and Justice of its own employees and coming to at least net zero Peace and Justice deterioration towards these employees 5. The IT-organization comes to net zero emissions in the entire peace and justice chain 6. Employees feel very safe 7. Employees feel they are treated fairly when it comes to disputes	1. The IT-organization provides counsellors to mediate 2. The IT-organization provides a complaint procedure & complaints committee 3. The organization is GDPR compliant 4. The IT-organization analyses the impact of its actions (and what it asks of its own employees) on the peace and justice of its own employees and inhabitants of the world and comes to a net positive peace and justice improvement 5. Employees feel very safe 6. Employees feel they are treated fairly when it comes to disputes

Table 12 Model, Social Foundation - Peace & Justice

4.1.2.6 Political Voice

Political voice on a global scale has to do with (as stated in chapter 3.1.1.1.1) ensuring people have voice in, and influence over, decisions that affect their lives (Democratic institutions, freedom of expression, freedom of association, and a free media support inclusive, participatory and representative decision making) and has a control variable based on voice and accountability.

Translating this global scale down to an organizational level means installing and analyzing ways for employees (and in the highest maturity level the (local) community) to influence organizational policy (voice) and assigning responsibility & enabling traceability (accountability) and the way these employees feel about this.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
1. The organization does not provide any type of method to collect feedback and enable co-determination 2. employees feel they have no voice in organizational policy and practices	1. The organization provides a suggestion box to collect feedback, feedback that leads to possible financial profit is taken into consideration 2. Employees feel they have a very limited voice in organizational policy and practices	1. The organization provides a councilor to collect feedback and suggest improvements to the board 2. Employees feel they have a voice in organizational policy and practices	1. The organization provides the opportunity, framework and funding for a works council (composed of employees) that represents the employees 2. Employees feel they have a strong voice in organizational policy and practices 3. The works council & organization aim at net zero emissions	1. The organization provides the opportunity, framework and funding for a works council (composed of employees) that represents the employees 2. Employees feel they have a strong voice in organizational policy 3. The organization provides or takes part in a (local) community council to generate (local) value and generate community feedback 4. The works council & organization aim at taking away more harmful emissions than are expelled into the environment

Table 13 Model, Social Foundation - Political Voice

4.1.2.7 Social Equity

Social equity on a global scale has to do with (as stated in chapter 3.1.1.1.1 ensuring equality of opportunity and reduce income inequality (inequalities are frequently exacerbated by inequalities of race and ethnicity, sexual orientation, religion, age, language, disability and location). Literally: the situation in which everyone is treated fairly and equally. (Camebridge Dictionary, 2021)

Translating this global scale down to an organizational level means looking at in what areas and what organizations can and do promote equal opportunity, how serious the organization is in properly organizing the endeavor and how employees and the (local) community feels about it.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
1. The organization does not ensure equality of opportunity and/or reduce income inequality amongst employees 2. Employees feel they or some of those around them are not treated as equals 3. Employees feel they or some of those around them are not financially compensated as equals	1. The organization ensures equal opportunity through equal rights and liberties where it pays to do so but does not (or reluctantly) reduce income inequality 2. Employees feel they and/or those around them are mostly treated as equals 3. Employees feel they or some of those around them are not financially compensated as equals	The organization ensures equal opportunity and reduces income inequality through: 1. matching national targets and ensuring equal rights and liberties 2. Employees feel they and those around them are treated as equals 3. Employees feel they and those around them are fairly financially compensate d as equals	The organization has its own Social Equity policy aimed at ensuring equal opportunity and income equality through: 1. Internal Diversification 2. Equal rights and liberties for all, especially focused on… a. Race b. ethnicity c. sexual orientation d. religion e. age f. language g. disability h. location 3. Informing and educating 4. Analyzing the impact of its actions on equal opportunity and the income equality of its own employees and coming to net zero social equity deterioration towards these employees 5. Finding interest groups and actively consulting them 6. Employees feel they and those around them are treated as equals 7. Employees and those around them are fairly financially compensated as equals	The organization has its own Social Equity policy aimed at ensuring equal opportunity and income equality through: 1. Internal Diversification 2. Equal rights and liberties for all, especially focused on… a. Race b. ethnicity c. sexual orientation d. religion e. age f. language g. disability h. location 3. Informing and educating 4. Analyzing the impact of its actions on equal opportunity and income equality and generating extra benefits for its employees and (local) community 5. Finding interest groups and actively consult and contribute to these 6. Employees feel they and those around them are treated as equals 7. Employees and those around them are fairly financially compensated as equals

Table 14 Model, Social Foundation - Social Equity

4.1.2.8 Gender Equality

Gender equality on a global scale (as stated in chapter 3.1.1.1.1) has to do with achieving gender equality and empowering all women and girls (Ensuring that women and girls have equal access to education, health care, decent work, and representation in political and economic decision-making processes).

When translating this to an organizational level this means things like access to education, health care, decent work and representation are still valid, but they morph to: Education and health care as translated to an organizational level earlier this chapter. An enjoyable job and internal (inside the organization) representation.

Also, this research finds the limitation to women and girls too constricting and referring more to sex ("A person's sex is typically based on certain biological factors, such as their reproductive organs, genes, and hormones." (MedicalNewsToday, 2020)) than genders and will generalize to gender and sex equality as all genders. It is important to note that a gender is "how they identify internally and how they express this externally. People may use clothing, appearances, and behaviors to express the gender that they identify with". (MedicalNewsToday, 2020)

These genders and sexes include but are not limited to: Female/Woman/Girl, Male/Man/Boy, Intersex, Agender, Androgyne, Bigender, Butch, Cisgender, Gender expansive, Genderfluid, Genderqueer, Masculine of Center, Nonbinary, Omnigender, Poly and Pangender, Transgender, Trans, Two Spirit. (MedicalNewsToday, 2020)

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The organization does not provide any (moral) rules, guidelines or policy to further the cause of gender equality	The organization provides some (moral) rules or guidelines to further the cause of gender equality but only non-binding (no penalties or consequences) and only as far as they are incentivized by financial gain or law	The organization provides some clear (moral) rules or guidelines that are binding (meaning there are consequences and/or penalties) to further the cause of gender equality	The organization has clear policy that: 1. Focusses on ensuring all genders (employees) equal access to: • Education • Health care • An enjoyable job • Internal representation 2. Finds and consults interest groups on the subject of gender equality 3. Analyzes the impact of its actions on the gender equality of its own employees and comes to net zero gender equality deterioration towards these employees	The organization has clear policy that: 1. focusses on ensuring all genders equal access to: • Education • Health care • An enjoyable job • Internal representation 2. Enforces gender equality by (voluntarily) setting gender equality quota's 3. Finds interest groups and actively consults and contributes to them on the subject of gender equality 4. Analyzes the impact of its actions on the gender equality of its employees and the (local) community and comes to net positive gender equality contribution

Table 15 Model, Social Foundation - Gender Equality

4.1.2.9 Housing

Housing on a global scale (as stated in chapter 3.1.1.1.1) has to do with decent, affordable, safe housing for all. And is based on the indicator what percentage of urban population is living in slum housing (but only in developing countries).

When translating this to an organizational level this means initially not looking at employee's personal housing (because, initially, the organization pays a wage that individuals are then able to buy or rent housing with but are not further responsible/involved in personal housing) but at the housing for employees during their workday (so, office space) and what is needed for proper housing of employees.

Proper housing: The Dutch Law (Arbowet) prescribes what proper housing when it comes to work is, conditions around: Lighting, solar-blinds, Temperature, abundance of breathable air etc. are described and have to be met.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not provide a well ventilated, heated in winter and cooled in summer, sound-safe, hygienic and pleasant workplace / office housing	The IT-organization provides very basic (below adequate): 1. Ventilation 2. Heat in winter 3. Cool in summer 4. Sound safety and… 5. Hygienic 6. A pleasant workplace / office housing for short-term financial gain	The IT-organization provides decent (adequate): 1. Ventilation 2. Heat in winter 3. Cool in summer 4. Sound safety and… 5. Hygienic 6. A pleasant workplace / office housing	1. The IT-organization has clear policy that focusses on ensuring all employees have: • Adequate ventilation • Heat in winter • Cool in summer • Sound safety • Hygienic • A pleasant workplace / office housing 2. The IT-organization analyzes the impact of its actions on the housing of its own employees and comes to net zero housing deterioration towards these employees 3. The IT-organization mediates for affordable, sustainable (net zero emissions) housing for employees	1. The IT-organization has clear policy that focusses on ensuring all employees have: • Adequate ventilation • Heat in winter • Cool in summer • Sound safety • Hygienic • A pleasant workplace / office housing 2. The IT-organization Analyzes the impact of its actions on the housing of its own employees and comes to a net positive housing contribution towards these employees 3. The IT-organization mediates for or creates affordable, sustainable housing for living in (that generates more resources than it uses) for its employees

Table 16 Model, Social Foundation - Housing

4.1.2.10 Networks

Networks on a global scale (as stated in the literature review) has to do with access to networks (of transport, communications and community support) with indicators around people with access to internet and population stating they do not have anyone to help them.

When translating this to an organizational level the meaning stays the same, but it is confined to a smaller form (an organization instead of the world). The indicators are therefore no good (because organizations will simply not know/have that data and/or are not (directly) responsible), hence this research will look at elements like (funding for) ways of communication and (funding for) ways of transport and support.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not provide any: 1. (Funding for) (public) transport from and to work 2. (Funding for) Ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. Employees feel they are out of touch with colleagues 5. Employees use and/or pay for their own (public) transport	The IT-organization provides: 1. Partial funding for ways of remote communication to come to a better financial result, like A. Phone B. Phone plan C. Computer D. Internet The organization does not provide: 2. (Funding for) (public) transport from and to work 3. (Funding for) Councilors 4. Employees feel in touch with their colleagues 5. Employees use and/or pay for their own (public) transport	The IT-organization provides: 1. (Funding for) (public) transport from and to work 2. (Funding for) Ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. Employees feel in touch with their colleagues 5. Employees use (public) transport funded or loaned (to them) by the organization	The IT-organization provides and has a clear policy on: 1. (Funding for) (public) transport from and to work 2. (Funding for) ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. Analyzing the impact of its actions on the networks of its own employees and comes to net zero network deterioration towards these employees 5. Coming to net zero emissions in the entire network 6. Employees feel in touch with their colleagues 7. Employees use (public) transport funded or loaned (to them) by the organization	The IT-organization provides and has a clear policy on: 1. (Funding for) (public) transport for the (local) community & employees 2. (Funding for) ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. (Funding for) A (local) outreach program 5. Analyzing the impact of its actions on the networks of its own employees and (local) community and actively contributes (knowledge, labor, funding, infrastructure) to them 6. Employees feel in touch with their colleagues and the (local) community 7. Employees use (public) transport funded or loaned (to them) by the organization

Table 17 Model, Social Foundation - Networks

4.1.2.11 Energy

Energy on a global scale (as stated in chapter 3.1.1.1.1) has to do with access to clean, affordable energy services for all, with indicators on lack of electricity and lack of cooking facilities.

When translating this to an organizational level the meaning stays the same, but it is confined to a smaller form (an organization instead of the world). The indicators are therefore no good (because organizations will simply not know/have that data and/or are not (directly) responsible), hence this research will look at elements like whether energy is available for employees at work, how this is generated/purchased and in higher maturity levels to what extent and whether this is shared with the community.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not make available any energy or generate any clean energy itself	The IT-organization makes energy available where it aids the financial gain of the organization and/or generates a little (but not enough by a long shot) (clean) energy which it uses and/or sells to the highest bidder for financial gain	The IT-organization makes energy available to all employees and/or generates clean energy (through wind, solar, heat and/or hydro) which it uses to limit its own footprint	1. The IT-organization makes (largely green) energy available to all employees 2. The IT-organization generates enough clean energy (through wind, solar, heat and/or hydro) to be energy neutral 3. The IT-organization shares its knowledge around getting to energy neutral terrain	1. The IT-organization makes green energy available to employees and (local) community 2. The IT-organization generates clean energy (through wind, solar, heat and/or hydro), generating more clean energy than it uses for operations a. This energy is shared (possibly against beneficial rates) with the (local) community 3. The IT-organization shares its knowledge around energy generation with the (local) community 4. Analyzes the impact of its actions on the energy of its own infrastructure and (local) community and comes to a net positive contribution towards the infrastructure and the (local) community

Table 18 Model, Social Foundation - Energy

4.1.2.12 Water and Sanitation

Water and Sanitation on a global scale (as stated in chapter 3.1.1.1.1) has to do with access to clean water and decent sanitation for all, with indicators on lack of access to improved drinking water and sanitation.

When translating this to an organizational level the meaning stays the same, but it is confined to a smaller form (an organization instead of the world). This research will therefore look at availability of clean water (generation), toilets and in higher maturity levels to what extent and whether this is shared with the community.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The organization does not provide or generate any clean water or toilets and soap	The organization purchases and provides clean water, toilets and soap to its employees to keep them working (financial gain is motivation)	The organization provides clean water, toilets and soap to its employees and either: 1. Generates a (small) portion of their water use themselves 2. Compensates the use of water by a financial construction	The organization provides clean water, toilets and soap to their employees and: 1. Generates enough water to compensate their use or… 2. Compensates the use of water by a financial or replenishing construction and… 3. Analyses the impact of its actions on the water and sanitation of its own employees and comes to net zero water and sanitation deterioration towards these employees 4. Comes towards net zero emissions	The organization provides clean water, toilets and soap and either: 1. Generates enough water to add to the (local) community 2. Analyzes the impact of its actions on the water and sanitation of its own employees and (local) community and comes to a net positive contribution towards these employees and the (local) community

Table 19 Model, Social Foundation - Water and Sanitation

4.1.3 Ecological Ceiling

The ecological ceiling consists of 9 aspects; however, these aspects are not all translated to the organizational level in this research. This is because 2 of the 9 aspects do not have a fixed boundary generally accepted by science as of yet, it is therefore difficult to set requirements when the goal is not clear.

4.1.3.1 Climate Change

Climate change is mainly caused by rising CO_2 levels in the atmosphere, mainly emitted by the burning of fossil fuels. On the other end, forests (trees, plants) convert CO_2 to breathable air, however humanity is cutting down a significant amount of forest on a daily basis meaning the balance is entirely gone (humanity is adding more CO_2 and taking away the very thing that enables reduction). (European Commission, n.d.)

Climate change on a global scale (as stated in chapter 3.1.1.1.2) has to do with atmospheric CO_2 on a global level. However, when looking at a smaller instance, like an IT-organization it is better to steer on measures pertaining to CO_2 emissions as well as a base number.

To do this there are a great number of measures pertaining to two categories, namely (1) Design and (2) Renewables, waste and reduction.

These categories include but are not limited to measures such as:

- Green (building) design and strategy
- Material selection analysis
- Using CO_2 emissions as an important factor in (purchase) decisions
- Purchasing green electricity
- Drastically reducing or a stoppage of use of and investment in fossil fuels
- Sustainable mobility plans
- Waste audits
- (Financing the) Planting (of) forests
- Drawdown Technology and Sequestration
- Offering more plant-based food.

(Levin & Davis, 2019) (Anthesis Group, n.d.)

According to a study by the university of Leeds (to which Kate Raworth, the author of Doughnut Economics, sometimes refers) another control variable that can be used for this is 1.6 tons of CO_2 emissions per capita per year (to achieve the Paris Accord goals). (O'Neill D. , Fanning, Lamb, & Steinberger, 2018).

Now to scale these emissions per capita to emissions per employee the average length of time an employee spends at work will be used. The average workweek in The Netherlands is 31 hours in 5 days. Meaning employees in The Netherlands work 6.2 hours per day. A week has 168 hours, meaning 18% of the week is spent at work (CBS, 2020).

There are 52 weeks in a year, but The Netherlands handles a minimum of 4 weeks of vacation for every employee during the year (Rijksoverheid, n.d.). This means 48*31 = 1488 hours on a total of 8736 are worked per year excluding sick days and national Holidays. Which comes down to 17% of the year is spent at work. So, 1.6*0.17= 0.272 tons.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not think of, measure (from design/pre-purchase to execution/purchase to end of life), compensate or limit its CO_2 emissions	The IT-organization: 1. measures its CO_2 emissions and… 2. Slightly cuts CO_2 emissions (smaller initiatives when looking at the whole of the IT-organization) to avoid fines and/or boost income (inherent motivation is more profit)	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Limits its CO_2 emissions to 0.272 tons per employee per year (meeting the Paris Agreement goal of staying under 2 degrees centigrade global warming)	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and subtractions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Comes to net zero CO_2 emissions by (examples): *a. Design* i. Green (building) design and strategy ii. Material selection analysis iii. Using CO_2 emissions as an important factor in (purchase) decisions *b. Renewables, waste and reduction* i. Purchasing green electricity ii. Drastically reducing fossil fuel use and investment iii. Sustainable mobility plans iv. Waste audits v. (Financing the) Planting (of) forests vi. Drawdown Technology and sequestration vii. Offering more plant-based food than meat c. Finding and consulting interest groups on the subject of net zero CO_2 emissions 4. Encourages its network to do the same	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and subtractions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Takes more CO_2 out of the air than it puts in by (examples): *a. Design* i. Green (building) design and strategy ii. Material selection analysis iii. Using CO_2 emissions as an important factor in (purchase) decisions *b. Renewables, waste and reduction* i. Purchasing green electricity ii. No more fossil fuel use or investment iii. Sustainable mobility plans iv. Waste audits v. (Financing the) Planting (of) forests vi. Drawdown Technology and sequestration vii. Offering more plant-based food than meat c. Finding, consulting and actively contributing to interest groups on the subject of generative CO_2 solutions 4. Encourages its network to do the same

Table 20 Model, Ecological Ceiling - Climate Change

4.1.3.2 Ocean Acidification

Though this is a completely different (planetary) boundary, the cause of the acidification of the ocean is the same as climate change: CO_2 emissions. These emissions enter the ocean, react with the water and form carbonic acid. This leads to a decrease in the pH value of the ocean making it increase in acidity (or less basic) and lowering the carbonate ion concentrations. (National Oceanic and Atmospheric Administration, 2020) This means the same requirements that apply to climate change also apply to Ocean Acidification.

Now to scale these emissions per capita to emissions per employee the average length of time an employee spends at work will be used. The average workweek in The Netherlands is 31 hours in 5 days. Meaning employees in The Netherlands work 6.2 hours per day. A week has 168 hours, meaning 18% of the week is spent at work (CBS, 2020).

There are 52 weeks in a year, but The Netherlands handles a minimum of 4 weeks of vacation for every employee during the year (Rijksoverheid, n.d.). This means 48*31 = 1488 hours on a total of 8736 are worked per year excluding sick days and national Holidays. Which comes down to 17% of the year is spent at work. So, 1.6*0.17= 0.272 tons.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not think of, measure (from design/pre-purchase to execution/purchase to end of life), compensate or limit its CO_2 emissions	The IT-organization: 1. measures its CO_2 emissions and… 2. Slightly cuts CO_2 emissions (smaller initiatives when looking at the whole of the IT-organization) to avoid fines and/or boost income (inherent motivation is more profit)	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Limits its CO_2 emissions to 0.272 tons per employee per year (meeting the Paris Agreement goal of staying under 2 degrees centigrade global warming)	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and subtractions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Comes to net zero CO_2 emissions by (examples): *a. Design* i. Green (building) design and strategy ii. Material selection analysis iii. Using CO_2 emissions as an important factor in (purchase) decisions *b. Renewables, waste and reduction* i. Purchasing green electricity ii. Drastically reducing fossil fuel use and investment iii. Sustainable mobility plans iv. Waste audits v. (Financing the) Planting (of) forests vi. Drawdown Technology and sequestration vii. Offering more plant-based food than meat c. Finding and consulting interest groups on the subject of net zero CO_2 emissions 4. Encourages its network to do the same	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and subtractions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Takes more CO_2 out of the air than it puts in by (examples): *a. Design* i. Green (building) design and strategy ii. Material selection analysis iii. Using CO_2 emissions as an important factor in (purchase) decisions *b. Renewables, waste and reduction* i. Purchasing green electricity ii. No more fossil fuel use or investment iii. Sustainable mobility plans iv. Waste audits v. (Financing the) Planting (of) forests vi. Drawdown Technology and sequestration vii. Offering more plant-based food than meat c. Finding, consulting and actively contributing to interest groups on the subject of generative CO_2 solutions 4. Encourages its network to do the same

Table 21 Model, Ecological Ceiling - Ocean Acidification

4.1.3.3 Ozone Layer Depletion

The Ozone layer is a stratospheric layer that absorbs UV radiation, meaning it protects the planet against harmful rays.

Chlorofluorocarbons and halons gasses were found in aerosol spray cans and refrigerants when the world did not know the damage that they were causing. In the 1980's it became known these substances, when released into the atmosphere, destroy the Ozone Layer.

As a response to this the Montreal Protocol was enacted in 1987, phasing out these gasses to restore (or at least not further damage) the ozone layer. (Union of Concerned Scientists, 2008)

Later, it was found that other chlorine and bromine compounds were also harmful for the ozone layer. (NASA, 2004) Over time, the protocol has been updated even further as to include more compounds that could cause harm to the ozone layer and climate, including hydrofluorocarbons, some of which are still being phased out. (Pinho, 2020)

The world is not yet rid of coolant-gasses that try to do it harm. Some hydrochlorofluorocarbons substitutes are still harmful, just less so. (Nunez, 2019)

To downscale this from a global view to a smaller, IT-organizational view is not that difficult, the tolerance on the use/emission of these substances does not change, 0 stays 0.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not think of, measure (from design/pre-purchase to execution/purchase to end of life), compensate or limit its chlorofluorocarbon, hydrochlorofluorocarbon and halons gas emissions nor does it limit bromine compounds	The IT-organization slightly limits its use of chlorofluorocarbon, hydrochlorofluorocarbon and/or halons gas emissions and bromine compounds to achieve a better short-term financial result (inherent motivation is more profit short-term)	The IT-organization has a clear policy that: 1. Measures its chlorofluorocarbon, hydrochlorofluorocarbon halons gas and bromine compound emissions 2. Completely stops any chlorofluorocarbon and halons gas emissions 3. Severely limits the use and emission of hydrochlorofluorocarbon and bromine compounds	The IT-organization has a clear policy that: 1. Measures its chlorofluorocarbon, hydrochlorofluorocarbon halons gas and bromine compound emissions 2. Completely stops any chlorofluorocarbon, hydrochlorofluorocarbon, halons gas and bromine compound use and emissions 3. Finds and consults interest groups on the subject of net zero ozone layer depleting emissions 4. Encourages Network to do the same	The IT-organization has a clear policy that: 1. Measures its chlorofluorocarbon, hydrochlorofluorocarbon halons gas and bromine compound emissions 2. Completely stops any chlorofluorocarbon, hydrochlorofluorocarbon, halons gas and bromine compound use and emissions 3. Finds, consults and actively contributes to interest groups on the subject of being generative on ozone layer depletion 4. Encourages Network to do the same

Table 22 Model, Ecological Ceiling - Ozone Layer Depletion

4.1.3.4 Nitrogen & Phosphorus Loading

According to research performed by the University of Leeds the planetary boundary for Phosphorus mining and use is 6.2 Tg (Tera-gram) per year, it continues by scaling this down to 0.9 kg per year, per capita. The planetary boundary for Nitrogen use in industrial and intentional biological fixation is 62 Tg per year, the study continues by scaling this down to 8.9kg per year, per capita. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

This means the natural process of the planet can sustain these numbers without harmful consequences, which is why -for this aspect- the mission zero maturity level is not actually zero emissions but the number of emissions that keep the planet's cycle in balance.

For the doing your fair share maturity level, the goal of the Dutch government to limit Nitrogen emissions to 50% of Nitrogen emissions/use of 2019 by 2030 was the central input. (Remkes, et al., 2020) The Dutch government has not formulated a goal for Phosphorus emissions/use, however the assumption is made this will also be limited to 50% of emissions/use of 2019 by 2030 because these 2 substances share a balance that needs to be maintained. (Trouw, 2020)
Emissions in 2020 were 494 million kg Nitrogen and 156 million kg Phosphorus in The Netherlands. (Esselink, 2020) Dividing these numbers by 2 (50% reduction in 2030) and then by 17 million (the rounded of number of inhabitants of The Netherlands) brings us to 14.53 (Nitrogen) per capita and 4.58 (Phosphorus) per capita emissions.

Now to scale these emissions per capita to emissions per employee the average length of time an employee spends at work will be used. The average workweek in The Netherlands is 31 hours in 5 days. Meaning employees in The Netherlands work 6.2 hours per day. A week has 168 hours, meaning 18% of the week is spent at work (CBS, 2020).

There are 52 weeks in a year, but The Netherlands handles a minimum of 4 weeks of vacation for every employee during the year (Rijksoverheid, n.d.). This means 48*31 = 1488 hours on a total of 8736 are worked per year excluding sick days and national Holidays. Which comes down to 17% of the year is spent at work. So, 4.6*0.17= 0.782kg per year and 14.5*0.17= 2.465 and 0.9*0.17 = 0.153kg and 8.9*0.17 = 1.513kg.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The organization does not think of, measure, compensate or limit its nitrogen and/or phosphorus emissions	The organization slightly limits its use of nitrogen and/or phosphorus emissions where this leads to a better short-term financial result (inherent motivation is more profit short-term)	The organization has a clear policy that: 1. Measures its Phosphorus and Nitrogen emissions 2. Limits its Phosphorus emissions to 0.782kg per year per employee by 2030 3. Limits its Nitrogen emissions to 2.465kg per year per employee by 2030 In order to match the Dutch National Goal	The organization has a clear policy that: 1. Measures its Phosphorus and Nitrogen emissions (per subset of the IT-organization) 2. Limits its Phosphorus emissions to 0.153kg per year per employee 3. Limits its Nitrogen emissions to 1.513kg per year per employee 4. Finds and consults interest groups on the subject of being net zero on Nitrogen & Phosphorus Loading 5. Encourages Network to do the same	The organization has a clear policy that: 1. Measures its Phosphorus and Nitrogen emissions (per subset of the IT-organization) 2. Limits its Phosphorus emissions to *lower* than 0.153kg per year per employee 3. Limits its Nitrogen emissions to *lower* than 1.513kg per year per employee 4. Sequesters Phosphorus & Nitrogen 5. Finding, consulting and actively contributing to interest groups on the subject of being generative on Nitrogen & Phosphorus Loading 6. Encourages network to do the same

Table 23 Model, Ecological Ceiling - Nitrogen & Phosphorus Loading

4.1.3.5 Freshwater Withdrawals

According to research the planetary boundary for freshwater withdrawal is 4000 km^3 per year. (Rockström, et al., 2009) The University of Leeds continued upon this research by scaling this down to 574 m^3 per year, per capita. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

This research defines this metric as the fair share metric because matching this will sustain the freshwater cycle and keep the planet reasonably healthy. From there on it is only logical that mission zero and do generative are the better options that will allow nature (and humanity with it) to thrive.

Now to scale these freshwater withdrawals per capita to freshwater withdrawals per employee the average length of time an employee spends at work will be used. The average workweek in The Netherlands is 31 hours in 5 days. Meaning employees in The Netherlands work 6.2 hours per day. A week has 168 hours, meaning 18% of the week is spent at work (CBS, 2020).

There are 52 weeks in a year, but The Netherlands handles a minimum of 4 weeks of vacation for every employee during the year (Rijksoverheid, n.d.). This means 48*31 = 1488 hours on a total of 8736 are worked per year excluding sick days and national Holidays. Which comes down to 17% of the year is spent at work. So, 574*0.17= 97.58 m^3.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not think of, measure, compensate or limit its freshwater withdrawals	The IT-organization limits the use of freshwater withdrawals where this leads to a better short-term financial result (inherent motivation is more short-term profit) and is otherwise uninvolved	The IT-organization has a clear policy and process that: 1. Measures its Freshwater withdrawal 2. Limits its freshwater withdrawal to 97.58 m^3 per employee, per year	The IT-organization has a clear policy that: 1. Measures its freshwater withdrawal per subset of the IT-organization 2. Comes to net zero freshwater withdrawal (often closed loop systems and compensation) 3. Encourages finding and consulting interest groups on the subject of net zero freshwater withdrawal 4. Encourages Network to do the same	The IT-organization has a clear policy that: 1. Measures its freshwater withdrawal per subset of the IT-organization 2. Adds more freshwater to its environment / (local) community than it takes out (often closed loop system fed by rainwater recovery and recycling used water) 3. Encourages finding, consulting and actively contributing to interest groups on the subject of being generative on freshwater 4. Encourages network to do the same

Table 24 Model, Ecological Ceiling - Freshwater Withdrawals

4.1.3.6 Land conversion

According to research performed by the University of Leeds the planetary boundary for land conversion comes down to 1995 Mha (Million hectare), or 0.3 ha per capita (O'Neill D. , Fanning, Lamb, & Steinberger, 2018).

Land conversion in a global sense is about the percentage of global land cover (forests) converted to cropland (as stated in chapter 3.1.1.1.2). When translated to an IT-organizational level it seems only obvious that this is translated to the amount of land which is repurposed to business activities per employee.

For this particular aspect, the mission zero maturity level is different. It is extremely difficult if not impossible to not convert/devote any space to working on business activities (it just requires a space, office building or something of the like). So, mission zero in this instance is the obtaining of the right ratio of land to building calculated by number of employees.

The previous paragraph also has implications for being generative, in this instance that includes taking up less space than the 0.3 ha, thereby generating a buffer to the planetary boundary (or compensating for another organization's overshoot, which is a different way of viewing the same thing).

Now to scale the land conversion per capita to land conversion per employee the average length of time an employee spends at work will be used. The average workweek in The Netherlands is 31 hours in 5 days. Meaning employees in The Netherlands work 6.2 hours per day. A week has 168 hours, meaning 18% of the week is spent at work (CBS, 2020). There are 52 weeks in a year, but The Netherlands handles a minimum of 4 weeks of vacation for every employee during the year (Rijksoverheid, n.d.). This means 48*31 = 1488 hours on a total of 8736 are worked per year excluding sick days and national Holidays. Which comes down to 17% of the year is spent at work. So, 0.3*0.17= 0.051 ha.

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not think of, measure, compensate or limit its land conversion	The IT-organization limits its land conversion where this leads to a better short-term financial result (inherent motivation is more short-term profit) but has no clear policy that is about a bigger goal than its own financial gain	The IT-organization has a clear policy that: 1. Measures its land conversion (land used for business ends) 2. Compensates slightly for overshoot by (examples) a. Planting forest b. Financial construction / compensation	The IT-organization has a clear policy that: 1. Measures its land conversion (land used for business ends) per subset of the IT-organization 2. Limits its net land conversion to 0.051 ha per employee 3. Encourages finding and consulting interest groups on the subject of net zero freshwater withdrawal 4. Encourages Network to do the same	The IT-organization has a clear policy that: 1. Measures its land conversion (land used for business ends) per department 2. Land conversion limited to below 0.051 ha per employee 3. Encourages finding, consulting and contributing to interest groups on the subject of net zero freshwater withdrawal 4. Encourages Network to do the same

Table 25 Model, Ecological Ceiling - Land Conversion

4.1.3.7 Biodiversity Loss

Biodiversity Loss is on a global scale is calculated by calculating the rate of species extinction per million species per year (as stated in chapter 3.1.1.1.2). To stay within the planetary boundary no more than 10 species can go extinct per year. (Raworth, 2017)

According to the American National Museum of Natural History it is arduous to pinpoint the exact amount of biodiversity loss due to the difficulty involved in identifying the exact rate of extinction. The reason for that is because humanity simply has not found and/or studied all species on our planet as of yet. However, studies estimate a total number of around 8 million species. Regardless, scientists and studies agree that the extinction rate is hundreds or even thousands of times higher than the natural baseline rate. (The Smithsonian, n.d.)

The Millennium Ecosystem Assessment calculated an extinction rate of 8700 species per year (24 per day) and scientists at the United Nations Convention on Biological Diversity later stated every day 150 (54,750 per year) species are lost. (Pearce, 2015)

On any (including a smaller, IT-organizational) scale this translates to four aspects that need to be analyzed:

4.1.3.7.1 Species Diversity

This is the unique collection of species living inside an ecosystem. An ecosystem with a lot of different species but no species outnumbering the rest is considered to have a high species diversity. (Sciencing, 2018)

4.1.3.7.2 Genetic Diversity

Describes how closely related species within a single ecosystem are. If a large portion of/all members have similar genes the species has a low genetic diversity. Because of their small populations, endangered species may have low genetic diversity due to inbreeding. (Sciencing, 2018)

4.1.3.7.3 Ecosystem Diversity

A region can have a wide array of ecosystems or only a few or even one. Big parts of the ocean or deserts have a low ecosystem diversity. (Sciencing, 2018)

4.1.3.7.4 Functional Diversity

The way species behave, obtain resources and food. Behavior of species can show gaps in a food cycle or ecological niches that are lacking species. (Sciencing, 2018)

Looking at the planetary boundary of 10 extinctions per million, per year and the estimated extinction rate, this means the planet cannot afford for (IT-)organizations that allow for the extinction of species. The Do Mission Zero maturity level brings the extinction level back to the natural rate (if all organizations adhere to it).

DO NOTHING	DO WHAT PAYS NOW	DO YOUR FAIR SHARE	DO MISSION ZERO	DO GENERATIVE / DISTRIBUTIVE
The IT-organization does not think of, measure, compensate or limit biodiversity loss it causes	The IT-organization protects some biodiversity, but only looks at species diversity and only when forced to do so to prevent fines or bad reputation that would be harmful for the financial growth, short term (inherent motivation is short-term financial gain)	The IT-organization has a clear policy that: 1. (Periodically) Analyses and assesses the species- and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) design 2. Relocates, removes or terminates as little species as possible	The IT-organization has a clear policy that: 1. (Periodically) Analyses and assesses the species-, genetic-, ecosystem- and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) (re-)design 2. Relocates as little species as possible 3. Removes or terminates no species that are in any way thought of as being even remotely close to endangered 4. Encourages finding and consulting interest groups on the subject of biodiversity (loss) 5. Encourages Network to do the same	The IT-organization has a clear policy that: 1. (Periodically) Analyses and assesses the species-, genetic, ecosystem and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) (re-)design 2. Periodically) Analyses and assesses the impact it has on species-, genetic, ecosystem and functional diversity of its (local) community and integrates the outcome into the business 3. Finds, introduces and takes good care of endangered species that are perfect for the owned or used (by IT-organization) workplace and land(scape) 4. Relocates, removes or terminates no species that are in any way thought of as being even remotely close to endangered 5. Encourages finding, consulting and actively contributing to interest groups on the subject of biodiversity loss 6. Encourages Network to do the same

Table 26 Model, Ecological Ceiling - Biodiversity Loss

4.2 Question asked to categorize

To analyze how IT-organizations fit within these requirements per aspect of Doughnut Economics and the Design Traits a survey will be used in which the tables containing the requirements per aspect of Doughnut Economics and the Design Traits will be shown in which the maturity level names ("Do Nothing" through to "Do Generative / Distributive") will be replaced by "A" through "E" and the question "*Which situation describes your organization best?*" will be posed per table.

4.3 Categorizing an organization

This subchapter explains how individual IT-organizations are categorized as one single maturity level. Because it is highly unlikely an IT-organization will score consistently in only one maturity level, but in most cases in a few different maturity levels.

4.3.1 Points per Question

There are a total of 24 questions (1 per aspect of Doughnut Economics and the Design Traits) that ask IT-organizations to assess themselves on the maturity level scale having to do with Doughnut Economics and the Design Traits. Being categorized in the lowest level will give the IT-organization 1 point, the 2nd 2 points, the 3rd 3 points, the 4th 4 points and finally the 5th will deliver 5 points.

MATURITY LEVEL	WORTH IN POINTS
DO NOTHING	1
DO WHAT PAYS NOW	2
DO YOUR FAIR SHARE	3
DO MISSION ZERO	4
DO GENERATIVE / DISTRIBUTIVE	5

Table 27 Points per Maturity Level

4.3.2 Categorization Ranges

This means the minimum number of points one can achieve is 24 points (24 aspects * the lowest score of 1 = 24) and the highest number of points one can achieve is 120 points (24 aspects * the highest score of 5 = 120).

To categorize an organization the following distribution has been made, meaning an organization will fall in one of the 5 maturity levels if it scores a certain number of points.

MATURITY LEVEL	RANGE OF POINTS
DO NOTHING	24 up to and including 43
DO WHAT PAYS NOW	44 up to and including 62
DO YOUR FAIR SHARE	63 up to and including 82
DO MISSION ZERO	83 up to and including 102
DO GENERATIVE / DISTRIBUTIVE	103 up to and including 120

Table 28 Categorization Ranges

4.3.3 Concentration Correction of Aspects

If, after the assessment of all questions, the point total comes to 63 or more 2 new rules come into effect:

> *If 30% (7 of 24 aspects) of total aspects are 2 columns or more outside the established maturity level the spread is too great to speak of a decent, thorough sustainability approach and a 10 points deduction will follow.*

If 55% (4 of 7 Ecological or 9 of 17 Design Traits/Social) of aspects within an element (Ecological or Social) are 2 columns or or more outside the established maturity level the spread is too great to speak of a decent, thorough sustainability approach and a 10 points deduction will follow.

*Example: If an IT-organization scores 70 points, firmly putting it in the "Do Your Fair Share" maturity level, but 7 of the IT-organization's aspects are in "Do Nothing" and 7 are in "Do Generative / Distributive" the organization has more than the allowed 30% (or 7 aspects) of aspects 2 columns outside the established maturity level and a 10 points deduction will follow. Meaning the IT-organization's point total will drop from 70 to 60 points and it drops to a lower overall maturity level ("Do What Pays Now" in this case).

4.4 Sustainability consideration

So, it is now known when an organization is deemed which maturity level, however now the next question arises: When is an organization considered sustainable?

To be considered sustainable an organization needs to at the very least "Do its Fair Share". In the definition of this maturity level as set forth by Kate Raworth there is a dichotomy between organizations who feel they are doing their fair share and organizations who actually do their fair share. She writes "as anyone knows when left holding the restaurant bill after friends have chipped in for a big meal out, what we think is our 'fair share' rarely adds up to what's actually needed." (Raworth, 2018)

4.4.1 Maturity Sub-Levels

This leads to splitting up the "Do Your Fair Share" maturity level in 2 sub-levels:

- Attempting to Do Your Fair Share
- Doing Your Fair Share Success

4.4.2 Categorization Ranges

This means that when scored within the 63 up to and including 82 range another analysis takes place, categorizing the organization on the previously named 2 sub-levels.

MATURITY LEVEL	RANGE OF POINTS	CONSIDERED SUSTAINABLE?
ATTEMPTING TO DO YOUR FAIR SHARE	63 up to and including 72	No
DOING YOUR FAIR SHARE SUCCESS	73 up to and including 82	Yes

Table 29 Sustainable Categorization Ranges - Doing Your Fair Share

If / when an organization is categorized in the "attempting to do Your Fair Share" maturity level an organization is not considered sustainable. If / when an organization is categorized in the

“Doing Your Fair Share Success” maturity level an organization is considered sustainable. This means any score of 73 and above is considered sustainable.

An overview checkmark table displaying the maturity levels on the (top) row and purpose on the (first) column can be found in appendix VI.

5 Methodology

This chapter describes the methodology that was applied to conduct this research. The process behind the research is elucidated, the way questions are asked is explained, a survey is used to gather the data and both the structure of the survey as well as the process behind the data collection is explained. The chapter will conclude with an explanation of which statistical tests will be used to display findings in the next chapter(s).

5.1 Research Methodology

This sub-chapter will describe the choice between qualitative and quantitative research and elucidate the overall method used to come to a thorough end-result.

5.1.1 Qualitative and quantitative

For this research the choice fell on making a split in part qualitative and quantitative and part exploratory and part confirmatory work that is both primary (survey) and makes use of secondary data collected by others. This is done because there is a part of this research that focusses on a redefinition of a term ("Sustainable IT") based on an existing (but novel) model in economics (called Doughnut Economics). This is achieved mostly through literature review (see chapter 3); all of this is a qualitative exercise.

The method that was applied to evaluating the practicality of the model that will be created to measure the sustainability (when measured against this new definition of IT Sustainability) will be a mix of qualitative and quantitative through the execution of semi-structured interviews (qualitative) with experts on the subject of (IT) sustainability within organizations and comparing the answers/outcomes to each other.

A sample of Dutch IT-organizations was measured quantitatively through a questionnaire spread throughout organizations within The Netherlands. Due to the limited scope of this research a sample had to be selected. To achieve a representative sample of organizations, reach enough subjects and receive enough replies, the ideal solution would be to do a large-scale survey among a representative sample of Dutch IT-organizations at a later point in time.

5.1.2 Overall method schema

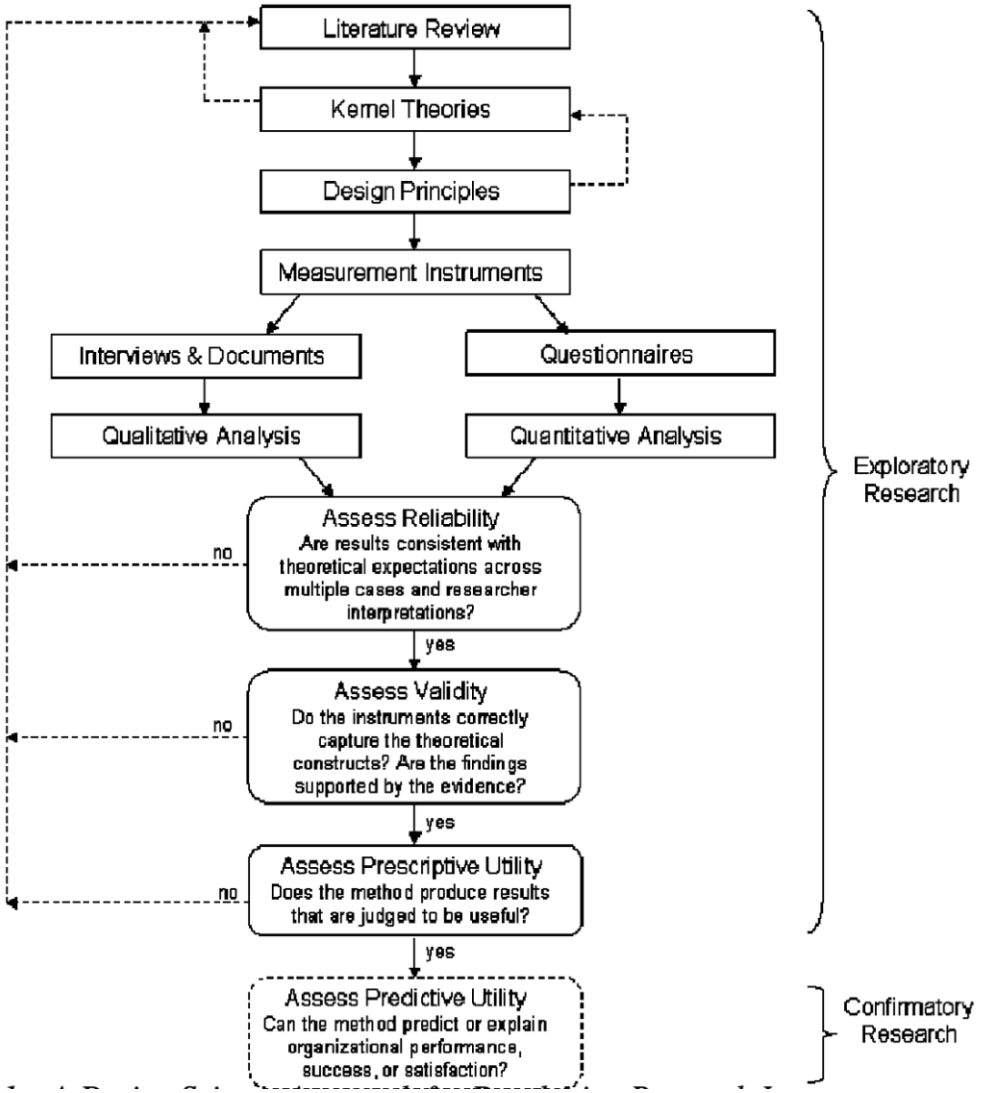


Figure 11 - A Design Science Approach for Developing Research Instruments (McClaren & Buijs, 2011)

The figure above will form a loose basis of how the research will be conducted.

First, literature will be reviewed, Kernel (or fundamental) theories will be identified (see chapter 3), and definitions will be set. Through these elements a measurement instrument will be constructed which will be evaluated and refined by evaluation and interviews with 4 experts in different disciplines and further documentation/theories.

Eventually the revised model will receive a test-run in which 5 people will be found and asked to fill in the survey to make sure the practicality is secured. After this step the survey is executed by a questionnaire to achieve the goal of test running the model.

5.1.3 Conceptualization Theory

To translate the requirements, rules, control variables, thresholds and statements meant for a global model to a less global, smaller and more defined form; IT-organizations, the Conceptualization Theory was used. (Fowler & Mayes, 1999)

According to this theory, leaning takes place in a cyclical 3 phases, namely: Conceptualization, construction and dialogue.

5.1.3.1 Conceptualization

This phase refers to the learner's initial contact with other peoples' concepts, it is where the learner's understanding of the subject as is meets new information. This phase is supported by content/theory that is designed by experts in the field.

In this research: Reading Doughnut Economics theory and conceptualizing this.

5.1.3.2 Construction

This phase is one where the learner applies the new conceptualized understanding to perform a task like writing or laboratory work.

In this research: Translating the conceptualized knowledge from a global level to an IT-organizational one.

5.1.3.3 Dialogue

This phase is one where concepts are further developed through a process of conversation with tutors and peers.

In this research: Discussion with experts about the translation of global to IT-organizational level

5.2 Interviews

To obtain verification of the constructed model, experts (on different sub-areas of sustainability, modelling and Doughnut Economics) were consulted. These experts received a copy of the model, as well as supporting theory at least 2 weeks before the interview date. They also received the questions that were to be posed at least 4 days before the interview date. This is confirmatory research.

5.2.1 Interview Design

Semi-structured, one-on-one, recorded, online interviews were conducted to maintain uniformity during the interviews and the surrounding processes and to decrease bias. One-on-one interviews were conducted to enable the researcher to capture the perspective of the interviewees and decrease the chance of any outside influence warping opinions.

The interviewees were given options to promote their comfort:

1. Allow video?
2. Dutch or English?
3. Allow Recording?

The first option provided was whether or not to allow video during the online call, the second decision the interviewees had to make was whether they would like to do the interview in Dutch or English, and the very last option for the interviewees was whether or not to allow recording for transcribing purposes.

A quick introduction to the interviewer, research (goal) and interview was given before the start of the interview. They were reminded that the interviewer was asking for their expert knowledge and opinion and a dialog about the subjects in the interview was wanted as to come to a better end result.

First, questions that would be easily comparable between different interviewees were posed. These questions were more introductory in nature and were centered around identification of person and organization as well as obtaining confirmation of their expert status.

This was followed by 2 questions about the model in general/as a whole to allow for some overarching views and advice. Finally, questions about sub-areas of the model were asked, this was done to achieve a deep dive in which a dialog would occur due to breaking down the model to smaller chunks. Participants were invited to expand on each of the aspects of Doughnut Economics which were included in the model.

As stated, the goal was a dialog in which the model was verified, this means the interviewer attempted to encourage the interviewee to expand and clarify by using neutral continuation suggestions. The interview protocol and questions (see appendix III - Interview Protocol & Questions) include examples of neutral continuation prompts.

5.2.2 Expert Acquisition Strategy

The requirements for the experts that were consulted are based around the subject of the research. To find these the research focused on finding someone with an extensive network in IT/digital society (especially in relation to sustainability) and found that in Frank Hartkamp and the organization he represents; Rijksdienst voor Ondernemend Nederland (RVO, Netherlands Enterprise Agency).

Requirements were constructed to come to a well substantiated list of experts, these experts do not represent a representative sample but are specific experts that are used to validate and improve the created model.

These requirements were to find people who have a proven expertise* or who are proven to be experienced with 1 or more of these subjects:

- Ecological sustainability
- Social sustainability
- Doughnut Economics
    - Preferably with accompanying knowledge on the Design Traits
- Maturity Models
- Translating of models with a global character to models with an organizational character (downscaling).

*Expertise is –in this case- defined as: A person with extensive experience (5+ years) and/or (Academic) knowledge/education (University of Applied Sciences or University of Theoretical Sciences) in the fields mentioned above, who operate in a reputable organization.

This is based upon conceptualizing the "Experts May Have Influence, But What Makes An Expert?" article to three basic elements: Experience, knowledge and reputability. (Newman, 2014)

5.2.3 Sample Size

The experts do not represent a representative sample but are specific experts that are used to validate and improve the created model.

5.2.4 Analysis

The interviews were recorded and transcribed. Following these initial 2 steps the transcripts were analyzed (see appendix IV - Interview Analyses) using a method known as grounded theory.

This theory is made up out of these 3 steps:

1. Coding and Theorizing
2. Memoing and Theorizing
3. Integrating and Refining.

(Thomas, 2013)

5.2.5 Ethics

Interviewees were recruited (as stated) via an e-mail introduction through the organization (supervisor). Upon agreement to be interviewed the interviewees received a follow-up email providing more details and a short and long version of the model and supporting theory. 4 days before the interview they also received the interview questions. Participants were not compensated for their participation; however, they could receive a form with short feedback and a short (visual) analysis.

3 types of personal data were gathered before and during these interviews.

1. The email addresses and names of the interviewees
2. Demographic information of the interviewees
3. The recording of the interviews.

The data of the participants was anonymized after an initial check for correctness by the researcher.

5.3 Survey

To collect quantitative data interviews can be used, responses are recorded and categorized or rated after which they are statistically analyzed. The survey overview was used to design the survey. (Verhoeven, 2019)

5.3.1 Survey Design

The survey consists of 4 parts which were formed using the Survey Overview below.

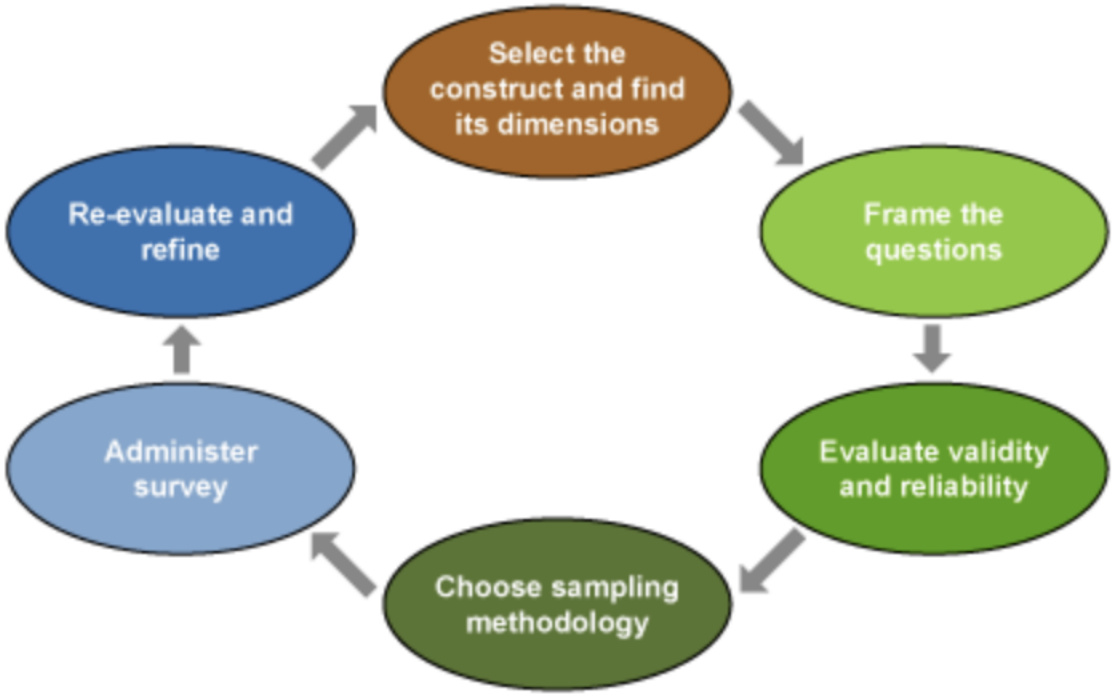


Figure 12 Survey Design Overview (Verhoeven, 2019)

Different dimensions exist, the first is the introductory message which makes the purpose, lengths and data-handling of the survey clear. The actual survey was split up in 4 pieces (see appendix V - Survey).

5.3.1.1 Part 1 – Identification

The first part is organizational introduction, meaning information about identification of the function, organization, size and industry will be obtained here.

5.3.1.2 Part 2 – Design Traits

The 2nd part is focused around the 5 Design Traits (as translated in this research) which are all organization-wide and although often used in the Doughnut Economics model is theory from a different writer (Kelly, 2012) and because of that the design traits are therefore separated from the rest of the model.

Data will be gathered by asking the respondents the question “Which situation describes your organization best?” while showing them the table with requirements per maturity level, per aspect of the Design Traits.

However, in this adjusted table of requirements (per maturity level, per aspect of the Design Traits) the maturity level names are left out and replaced by A through E as to not influence the respondents by a more positive or negative naming/framing. The respondent answers the question by filling in one of the 5 choices (A through E) in the checkbox (in which only one box can be checked) based on a 5-point Likert scale.

5.3.1.3 Part 3 – Doughnut Economics - Social

The 3rd part is focused on the Social aspects of Doughnut Economics as translated in this research.

Data will be gathered by asking the respondents the question “Which situation describes your organization best?” while showing them the table with requirements per maturity level, per aspect of the social element of Doughnut Economics.

However, in this adjusted table of requirements (per maturity level, per aspect of Doughnut Economics) the maturity level names are left out and replaced by “A through E” as to not influence the respondents by a more positive or negative naming/framing. The respondent answers the question by filling in one of the 5 choices (A through E) in the checkbox (in which only one box can be checked) based on a 5-point Likert scale.

5.3.1.4 Part 4 – Doughnut Economics - Ecological

The 4th part is focused on the Ecological aspects of Doughnut Economics as translated in this research.

Data will be gathered by asking the respondents the question “Which situation describes your organization best?” while showing them the table with requirements per maturity level, per aspect of the Ecological element of Doughnut Economics.

However, in this adjusted table of requirements (per maturity level, per aspect of Doughnut Economics) the maturity level names are left out and replaced by “A through E” as to not influence the respondents by a more positive or negative naming/framing. The respondent answers the question by filling in one of the 5 choices (A through E) in the checkbox (in which only one box can be checked) based on a 5-point Likert scale.

All information is treated as confidential, and any utterances or written statements will be anonymized, including (after analysis) the organization’s name.

The questions and proper functionality of the survey were validated and evaluated among the supervisors and local network. The substantive question themselves barely had to be validated/evaluated because they sprout from the model creation which was validated and evaluated during the interview phase. Feedback was generated from the review and was incorporated into the survey.

The sampling method chosen was the convenience sampling method in which participants are selected on the basis of availability and willingness to take part (however, with a certain target group and completely random within that group). (Shantikumar, 2018)

The survey was administered online. And as already stated: During the design phase of the survey, it was evaluated and refined multiple times.

5.3.2 Data Collection Process

This research will target organizations in 10 different industries / sectors, which are:

- Healthcare and Wellbeing
- Trade and Services
- Information and Communication Technology (ICT)
- Justice, Security and Public Administration
- Agriculture, Nature and Fishing
- Media and Communication
- Education, Culture and Science
- Engineering, Production and Construction
- Tourism, Recreation and Catering
- Transport and Logistics.

(Test Centrum Groei, n.d.)

Among 6 different sizes of organizations, which are:

- Micro organization
    - Organization with 9 or less working, active employees
- Small organization
    - Organization with 10 up to and including 49 working, active employees
- Medium organization
    - Organization with 50 up to and including 249 working, active employees
- Substantial organization
    - Organization with 250 up to and including 999 working, active employees
- Large organization
    - Organization with 1000 up to and including 4999 working, active employees
- Very Large organization
    - Organization with 5000 or more working, active employees.

(European Commission, 2016) (Large enterprise, 2020)

5.3.2.1 Organization sourcing and targeting

These organizations were found through the RVO's and the supervisor's network, the researcher's personal network and through an approach in which community organizations were approached to spread the information to their members (as to obtain a greater number of organizations by contacting a single one, allowing for more diffusion).

This research made use of the Qualtrics tool for surveys and collecting (and partially for visualizing) the data. The invitation e-mail is sent in Dutch and English, questions will however be in English and will be addressed to either: IT departments, Ranking employees within IT departments, Board members, Employees working in a green/sustainability office and/or Employees who can reroute this email to one of the above.

The survey was available for 7.5 weeks, starting 9th of April and ending the 30th of May.

6 Results and findings

In this chapter, the findings of the interviews and survey (and the results of those findings) are described after applying the methods that have been discussed previously. The results of the interviews are the first to be shown.

6.1 Results from Interviews

During the expert acquisition phase, a set of subjects (see chapter 5.2.2) were identified and chosen to acquire experts, the results of the interviews will be broken down by the information obtained during the interview questions about this subject but are not limited to the subject itself. The analyses that are the basis of this breakdown can be found in appendix II.

6.1.1 Who was interviewed?

Interviewee #	Function	Organization	Sub-set	Education & Experience
1	Onderzoeker (Researcher)	Milieu Centraal	Ecological Sustainability	- University of Amsterdam – Chemistry (MSc) - Utrecht University - Eerstegraads Scheikunde bevoegdheid
2	Bart Hellings	Rijksdienst voor Ondernemend Nederland (RVO)	Ecological Sustainability	- University of Wageningen - Milieu (BSc) - 30 years of experience (different functions to do with ecological sustainability)
3	Adviseur Duurzaam Door (Advisor Sustainability)	Rijksdienst voor Ondernemend Nederland (RVO)	Social Sustainability	- University of Wageningen - Agricultural Economics (MSc) - Has been operational in this field for over 10 years
4	Project Manager Sustainable Digitization	Municipality of Amsterdam	Doughnut Economics	- University educated - 5 years into social innovation - Working in digitization for 6 months - Doughnut Economics Courses
5	Senior Security Officer	Rijksdienst voor Ondernemend Nederland (RVO)	Maturity Models	- Open Universiteit - Business Process Management (Drs) - Working with maturity models for a long time

Table 30 Interviewee breakdown

6.1.2 Feedback Ecological Sustainability

For confirmatory research on the ecological sustainability subset of the model set forth in this thesis, 2 experts were consulted and a total of 43 pages of transcribed interview were produced.

Feedback collected includes feedback around *prioritizing some aspects of Doughnut Economics above others* as they are more applicable to IT. This feedback was taken into account and given form in the shape of using the term “IT-Organization” and “Organization” in the requirements of the maturity levels per aspect. However, the feedback to leave out some aspects in favor of others was not applied due to the fact that this research wants to apply Doughnut Economics to IT, not a part of it. Next to that, this thesis is also about the anchoring of IT sustainability in the rest of the organization, so these aspects are still of interest.

The observation was made that this thesis treats all organizations equal even though the nature of an organization, the products it produces and/or the industries the organizations operate in means the amounts might differ. An example of this is CO_2-emissions, a steel mill will emit more CO_2 than an accountancy firm. A solution that was suggested was *introducing a distribution key.* This was added to the further research section, along with the question whether a distribution key would be a good addition to the model.

Another piece of feedback was that the model really stuck to a policy level and the practicalities were wanted, however this research is aimed more at the policy level, setting goals.

Doubts about the *downscaled Nitrogen and Phosphorus aspect* were uttered, mainly centered around personal knowledge. The argument was that there are only issues with this around certain areas in The Netherlands (Natura 2000 areas). This led to more research on the subject, which confirmed the model’s original approach.

It was stated that this model gives *a good set of sustainability goals, structure and overview*. The point being that this was often lacking in organizations, and this led to bad policy and organizations that have no clue as to how they are doing. However, the point was made that more people and organizations would know about the concept of the SDG’s and that *linking the social aspects of the downscaled Doughnut to the SDG’s* would create more structure and allow for better understanding. This was done by adding an icon (or multiple icons) of the SDG(‘s) relevant to the aspect of the downscaled Doughnut Economics model to the Model Design chapter.

6.1.3 Feedback Social Sustainability

For confirmatory research on the social sustainability subset of the model set forth in this thesis, an expert was consulted and a total of 30 pages of transcribed interview were produced.

Feedback collected here includes feedback stating personal appreciation and agreement with *translating these models to an organizational* level to make it more tangible and to create a common language and jargon to communicate in about the subject of sustainability.

The observation was also made that the model would also be *suitable to be implemented at the organizational instead of the departmental (IT-organizational) level.* This also led to the question why an IT-department? To answer this question the introduction was altered to also show why IT needs this sustainability initiative.

Another great point of feedback was the fact that some of the *aspects had maturity levels that were unreachable due to the fact that there is already regulation by way of laws that prohibit this*. This was given voice in the model by coloring these maturity levels red and not filling them with requirements. This fixes a weakness that allowed for incorrect answers during the survey phase.

It was stated that *one of the 3 p's (profit) was missing in the model* in its entirety, it was explained this is not in the original model so it will not be in this one either.

There was some doubt about the *health aspect*, it stated that organizations could reach a higher maturity level by having a gym. The suggestion was made to *add funding for a gym membership to this*, this was added and fixes the problem that smaller organizations would not have been able to achieve higher levels due to the fact that these organizations might not have the possibility to invest the kind of capital to be able to build a gym.

The feedback to *leave out some aspects in favor of others* was not applied due to the fact that this research wants to apply Doughnut Economics, not a part of it to IT. Next to that, this thesis is also about the anchoring of IT sustainability in the rest of the organization, so these aspects are still of interest.

The model was also adapted by feedback stating that *(organized, structured and established) policy should start at the 3rd maturity level (Do Your Fair Share)* because being sustainable means having a policy. Up until this point organized policy started either at the 2nd (Do What Pays Now), 3rd (Do Your Fair Share) or 4th (Do Mission Zero) maturity level.

Another point of feedback that led to adaptation was the observation that it was unclear that *the further right in the model an organization scores (the more mature it becomes) the more organized and policy driven it becomes as well as the more outward thinking and circular it becomes*. So, a schematic overview was added to the model design chapter to show this.

The discovery that *the inclusion of local food was not made in the Food aspect* led to adding this to the (higher) maturity levels in the model, this fixes the problem that assessment on food would have been a lot weaker and more polluting.

It was also stated that a lot of *the social aspects of Doughnut Economics have strong affiliations and influence each other,* this means that it could be useful to state which aspects affect each other and in what manners, this will be added to further research.

6.1.4 Feedback Doughnut Economics

For confirmatory research on the subject of Doughnut Economics set forth in this thesis, an expert was consulted and a total of 28 pages of transcribed interview were produced.

Feedback collected here includes feedback stating personal appreciation and agreement with *translating these models to an organizational* level to make it more tangible and to create a common language and jargon to communicate in about the subject of sustainability.

The observation was also made that the model would also be *suitable to be implemented at the organizational instead of the departmental (IT-organizational) level.* This also led to the question why an IT-department? To answer this question the introduction was altered to also show why IT needs this sustainability initiative.

Another point of feedback that was given was that in the world of IT there is *a mindset of keeping the IT operating and functional and everything else comes second*, this needs to change and this needs to be included in a model around (organizational) IT. This feedback was applied by including this in the maturity levels of the governance aspect and including it in the schematic overview.

It was also stated that more needed to be done with *specific measures (such as waste disposal, material selection, recycling etc).* This comes down to *including more practicalities into the model,* this is however not the purpose of this thesis (it sets policy, goals) and was thus not applied.

Another interesting point was the suggestion *to add/mapp the circularity ladder model to the maturity levels*, this sounds like an extremely interesting suggestion and was added to the further research chapter of this thesis. Like the previous point, the next point of feedback was also added to the further research chapter of this thesis, this point being *how to exactly calculate outsourcing IT vs keeping it In House*.

The feedback to *leave out some aspects in favor of others* was not applied due to the fact that this research wants to apply Doughnut Economics to IT, not a part of it. Next to that, this thesis is also about the anchoring of IT sustainability in the rest of the organization, so these aspects are still of interest.

The original introduction *contained a sentence that was causing confusion*, this is part of what lead to rewriting the introduction.

Another point of feedback that led to adaptation was the observation that it was unclear that *the further right in the model an organization scores (the more mature it becomes) the more organized and policy driven it becomes as well as the more outward thinking and circular it becomes*. So, a schematic overview was added to the model design chapter to show this. An addition to this that was unlike the previous times this feedback had occurred was to broaden this to also include management assessment on sustainability. This was added to the schematic overview but also to the Governance Design Trait.

A point of criticism was that when reading the Design Traits (especially the Governance trait) the model *felt a lot like a model for a corporate entity* (not public), this was tackled by rephrasing and adding some clarification.

Another point about phrasing was about the maturity level "Do What Pays Now" (the 2nd maturity level), here there were some *utterances around brand popularity, cutting costs and greenwashing* where definitions were sometimes not applied properly, it was decided to not include the greenwashing definition in this thesis.

The observation that *weights should be added to define "good policy"* was also made, at this point the model already contained this and this was simply overlooked by the interviewee. However, this led to giving this another look which led to another rule being added to allow for a better weighing (it was now the case that an organization could basically score well on one element and score extremely bad on the other element and still be considered sustainable, this is unwanted, good sustainability policy includes both the social as well as the ecological element).

The model also includes an aspect called Ozone Layer Depletion, here *difficult terminology is used for different chemical compounds,* the interviewee indicated this was confusing and probably too difficult. This is however part of the model, operationalizing it even slightly means naming names, this feedback was not processed.

6.1.5 Feedback Maturity Model

For confirmatory research on the subject of Doughnut Economics set forth in this thesis, an expert was consulted and a total of 17 pages of transcribed interview were produced.

The first point of feedback was *to keep the model as generic as possible*; the goal is not to have a different model per industry but a universally applicable model. This was already the case (and part of the reason the policy level was picked as the level to focus on) but was reiterated. Another addition to this was the feedback that *the Maturity Levels were well defined*.

Another point of feedback was the *application of/mapping the CO_2-Ladder model* (which is used a lot in the public sector) to the newly developed IT applied Doughnut Economics model. This suggestion was added to the further research section.

Confirmation was given that *good policy means a tight grouping of aspects* as divided over the maturity levels. This means the extra rule by which scoring is done was approved.

The "Do What Pays Now" (2nd) Maturity level was *identified as the maturity level at which policy starts to form*. However, this is policy without structure, meaning that these are really loose initiatives which are carried by the organization mostly for quick financial gain. This was applied by allowing loose initiatives (which in this thesis are mostly not called policy) in the 2nd maturity level.

It was established that *the further to the right in the model one goes* (the more mature one becomes) *the more complexity this adds.* This was added to the schematic representation of the model and aims to give more clarity to readers.

The tip for *trial running the model* was given, meaning that in order to truly know the model is a good one it should be tested. This was done by molding the model into a survey, testing this on functionality in a small group and then trial running it with real participants. This removed weaknesses in language, functionality of the survey and overview.

6.1.6 Overlapping Feedback

In this sub-chapter the feedback that was given by multiple interviewees is displayed.

The feedback to leave out some aspects in favor of others was not applied due to the fact that this research wants to apply Doughnut Economics to IT, not a part of it. Next to that, this thesis is also about the anchoring of IT sustainability in the rest of the organization, so these aspects are still of interest.

Another piece of feedback by multiple interviewees was that the model really stuck to a policy level and the practicalities were wanted, however this research is aimed more at the policy level, setting goals.

Multiple interviewees stated their personal appreciation and agreement with *translating these types of models to an organizational* level to make it more tangible and to create a common language and jargon to communicate in about the subject of sustainability.

The call for more overview was clear amongst some of the interviewees, meaning they would like some kind of *schematic representation of what happens when maturing into the model*.

Another point of feedback that was shared amongst interviewees was that the Doughnut Economics model would also be *very translatable to an organization as a whole* (so not just the sub-set of an organization but also the organization as a whole). Clarification was added in the introduction and scope.

Multiple interviewees shared the thought that *weights should be added to allow for scoring "good policy"*, meaning that good policy means tight grouping in maturity levels between aspects.

6.2 Results from Survey

During the survey design phase, a survey was made, this sub-chapter shows what was asked and how this was answered. For this study 20 responses were collected.

6.2.1 Who responded?

Before sharing findings about sustainability, it is important that the background of respondents and organizations is described.

The respondents all represented different organizations, and a lot of different functions were present. However, these functions can be categorized to the following categories:

- Employee Sustainability
- Manager (General Management)
- C-level
- IT-Manager
- Teacher
- Trainee.

The Organizations that replied were all asked what industry they operate in. The following breakdown shows how the participants replied.

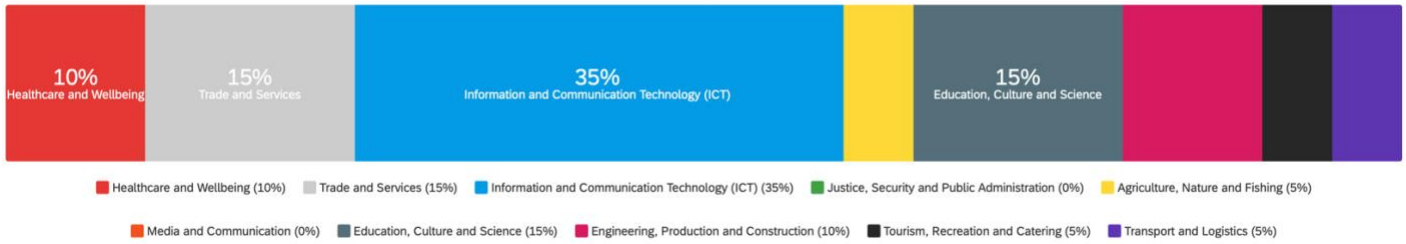


Figure 13 Respondents Organization Industry Breakdown

Here we can see that the largest percentage of respondents were active in the Information and Communication Technology (ICT) industry (35%), followed by the Trade and Services (15%) and Education, culture and Science (15%) industries.

The next breakdown shows what organizational size the organizations the participants belong to have.

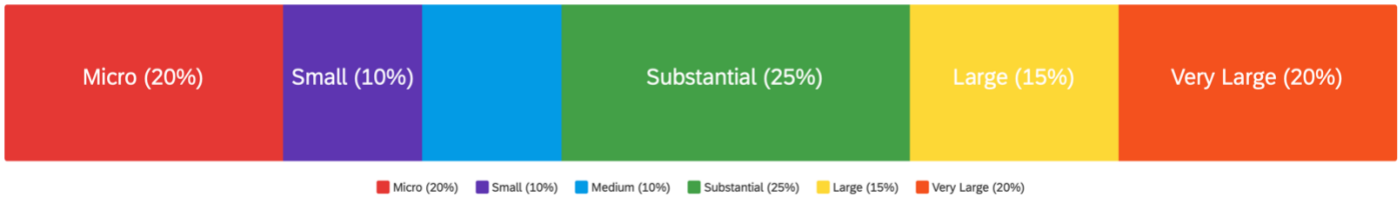


Figure 14 Respondent Organization Size Breakdown

Here we can see the largest percentage of respondents are part of a Substantial organization (25%), followed closely by respondents from Micro (20%) and Very Large (20%) organizations.
As a reminder, the organizational sizes are:

- Micro organization - Organization with 9 or less working, active employees
- Small organization - Organization with 10 up to and including 49 working, active employees
- Medium organization - Organization with 50 up to and including 249 working, active employees
- Substantial organization - Organization with 250 up to and including 999 working, active employees
- Large organization - Organization with 1000 up to and including 4999 working, active employees
- Very Large organization - Organization with 5000 or more working, active employees.

6.2.2 Results Survey - Design Traits

The first of three sustainability elements that will be treated are the Design Traits.

The average score per question has been calculated:

Aspect	Average Score
Purpose	3.45
Governance	3.4
Networks	3.3
Ownership	3.75
Finance	3.6
Average	**3.5** -> D (Do Mission Zero)

Table 31 Design Traits Average Score

6.2.2.1 Purpose

The respondents were asked about the *purpose* of the organization they represent, the following breakdown shows their replies.

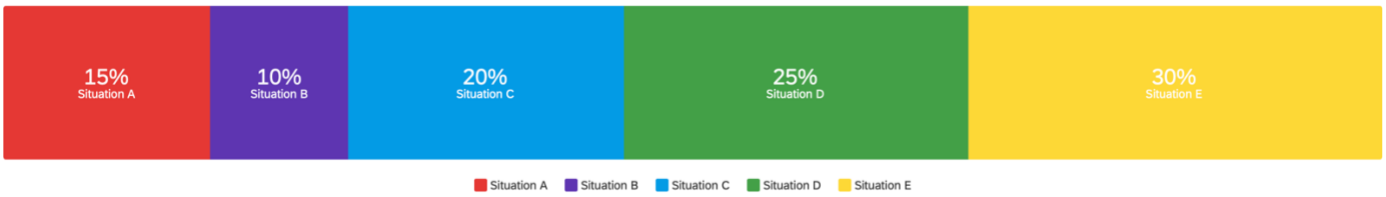


Figure 15 Survey Breakdown, Design Trait - Purpose

Here we can see the largest percentage of respondents picked situation E (maturity level: Do Generative / Distributive, 30%). After which situation D (Do Mission Zero, 25%) was picked most, closely followed by Situation C (Do Your Fair Share, 20%).

6.2.2.2 Governance

The respondents were asked about the *governance* of the organization they represent, the following breakdown shows their replies.

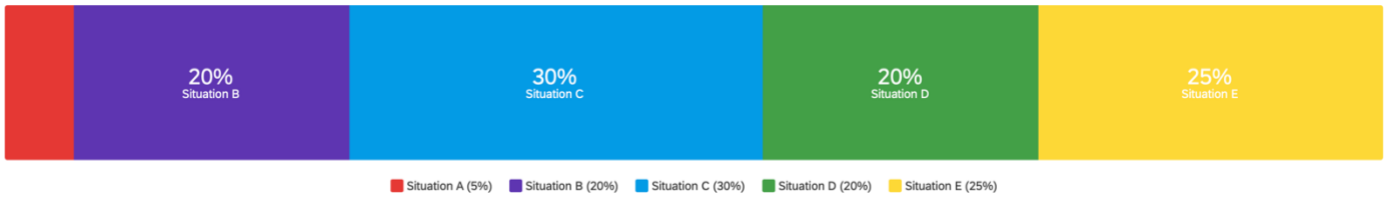


Figure 16 Survey Breakdown, Design Trait - Governance

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 30%). After which situation E (Do Generative/Distributive, 25%) was picked most, closely followed by Situation B (Do What Pays Now, 20%) and D (Do Mission Zero, 20%).

6.2.2.3 Networks

The respondents were asked about the *networks* of the organization they represent, the following breakdown shows their replies.

Figure 17 Survey Breakdown, Design Trait - Networks

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 50%). After which situation D (Do Mission Zero, 20%) was picked most, closely followed by Situation B (Do What Pays Now, 15%) and E (Do Generative/Distributive, 15%).

It is of note that no one selected situation A (Do Nothing).

6.2.2.4 Ownership

The respondents were asked about the *ownership* of the organization they represent, the following breakdown shows their replies.

Figure 18 Survey Breakdown, Design Trait - Ownership

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 45%). After which situation D (Do Mission Zero, 25%) and E (Do Generative/Distributive, 25%) were picked most.

It is of note that no one selected situation A (Do Nothing).

6.2.2.5 Finance

The respondents were asked about the *finance* of the organization they represent, the following breakdown shows their replies.

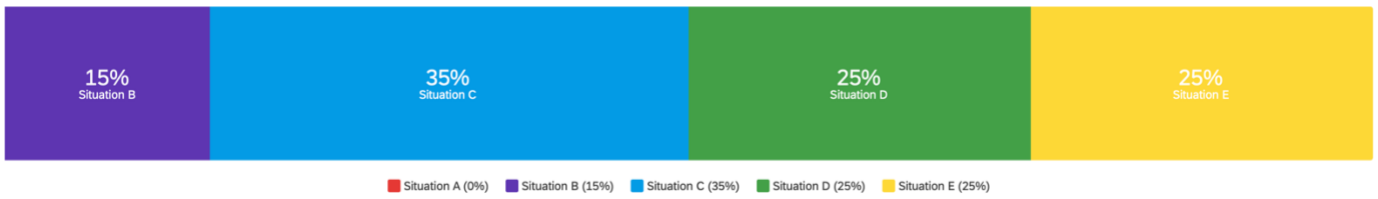


Figure 19 Survey Breakdown, Design Trait - Finance

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 35%). After which situation D (Do Mission Zero, 25%) and E (Do Generative/Distributive, 25%) were picked most.

It is of note that no one selected situation A (Do Nothing).

6.2.3 Results Survey - Social Sustainability

The second of three sustainability elements that will be treated is Social Sustainability.

The average score per question has been calculated:

Aspect	**Average Score**
Food	3
Health	3.7
Education	3.1
Income & Work	3.9
Peace & justice	3.4
Political Voice	3.35
Social Equity	3.55
Gender Equality	3.75
Housing	2.85
Networks	3.3
Energy	2.5
Water and Sanitation	3.05
Average	**3.29** -> C (Do Your Fair Share)

Table 32 Social Sustainability Average Score

6.2.3.1 Food

The respondents were asked about the *food* aspect of the organization they represent, the following breakdown shows their replies.

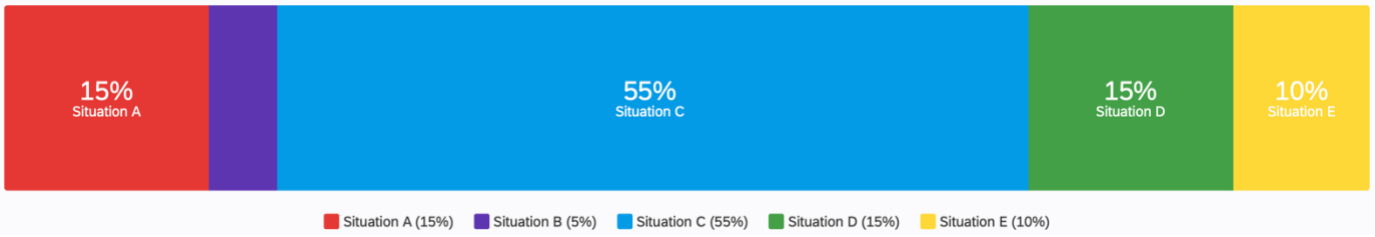


Figure 20 Survey Breakdown, Social Sustainability - Food

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 55%). After which situation D (Do Mission Zero, 15%) and A (Do Nothing, 15%) were picked most.

6.2.3.2 Health

The respondents were asked about the *health* aspect of the organization they represent, the following breakdown shows their replies.

Figure 21 Survey Breakdown, Social Sustainability - Health

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 50%). After which situation D (Do Mission Zero, 30%) and E (Do Generative/Distributive, 20%) were picked most.

It is of note that no one selected situation A or B (this was also not possible).

6.2.3.3 Education

The respondents were asked about the *education* aspect of the organization they represent, the following breakdown shows their replies.

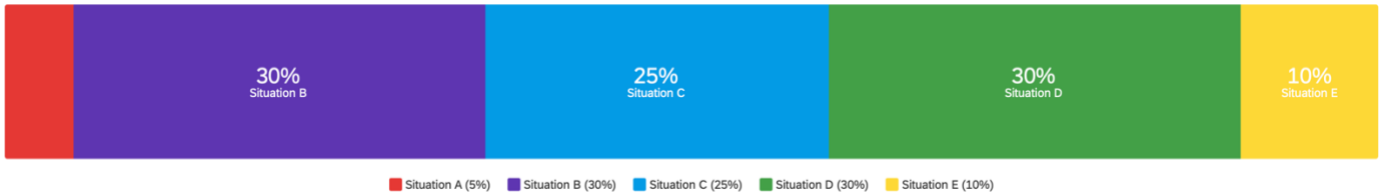


Figure 22 Survey Breakdown, Social Sustainability - Education

Here we can see the largest percentage of respondents picked situation B (maturity level: Do What Pays Now, 30%) and situation D (Do Mission Zero, 30%) after which situation C (Do Your Fair Share, 25%) was picked most.

6.2.3.4 Income & Work

The respondents were asked about the *income & work* aspect of the organization they represent, the following breakdown shows their replies.

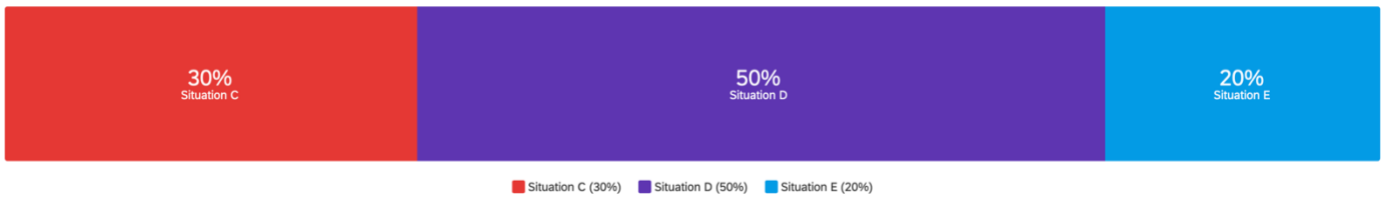


Figure 23 Survey Breakdown, Social Sustainability - Income & Work

Here we can see the largest percentage of respondents picked situation D (maturity level: Do Mission Zero, 30%), after which situation C (Do Your Fair Share, 30%) was picked most, followed by situation E (Do Mission Zero, 20%).

It is of note that no one selected situation A or B (this was also not possible).

6.2.3.5 Peace & Justice

The respondents were asked about the *peace & justice* aspect of the organization they represent, the following breakdown shows their replies.

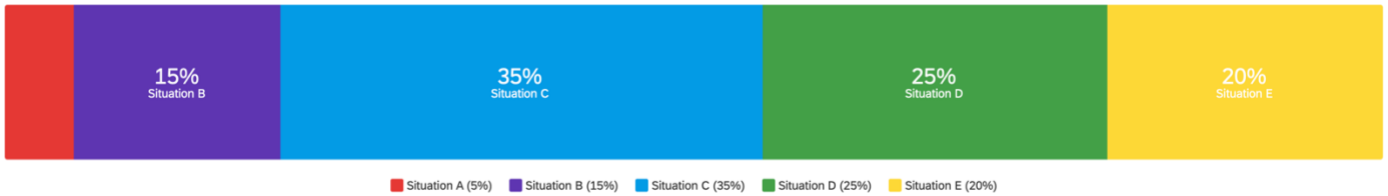


Figure 24 Survey Breakdown, Social Sustainability - Peace & Justice

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 35%), after which situation D (Do Mission Zero, 25%) was picked most, followed by situation E (Do Mission Zero, 20%).

6.2.3.6 Political Voice

The respondents were asked about the *political voice* aspect of the organization they represent, the following breakdown shows their replies.

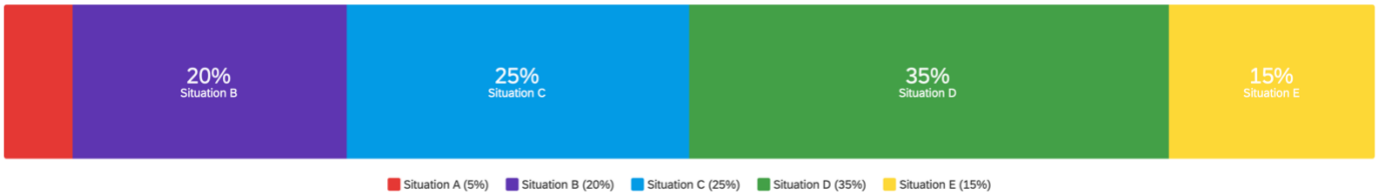


Figure 25 Survey Breakdown, Social Sustainability - Political Voice

Here we can see the largest percentage of respondents picked situation D (maturity level: Do Mission Zero, 35%), after which situation C (Do Your Fair Share, 25%) was picked most, followed by situation B (Do What Pays Now, 20%).

6.2.3.7 Social Equity

The respondents were asked about the *social equity* aspect of the organization they represent, the following breakdown shows their replies.

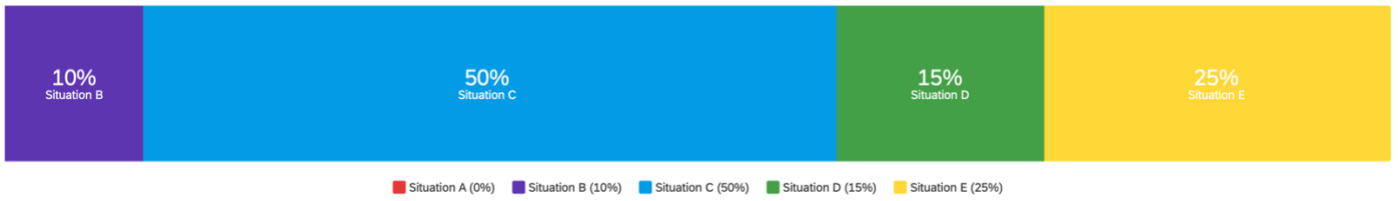


Figure 26 Survey Breakdown, Social Sustainability - Social Equity

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 50%), after which situation E (Do Generative/Distributive, 25%) was picked most, followed by situation D (Do Mission Zero, 15%).

It is of note that no one selected situation A.

6.2.3.8 Gender equality

The respondents were asked about the *gender equality* aspect of the organization they represent, the following breakdown shows their replies.

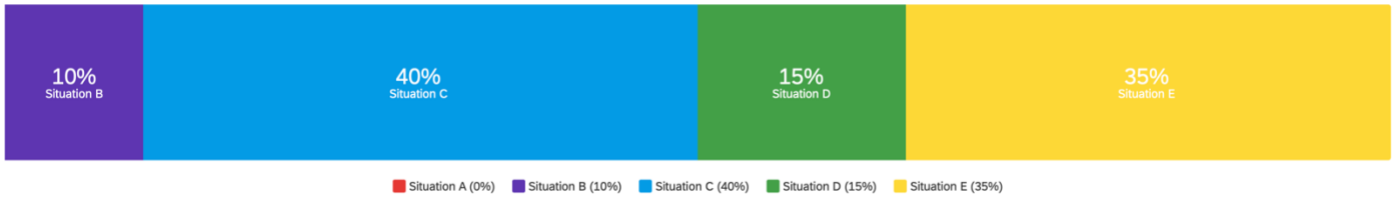


Figure 27 Survey Breakdown, Social Sustainability - Gender Equality

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 40%), after which situation E (Do Generative/Distributive, 35%) was picked most, followed by situation D (Do Mission Zero, 15%).

It is of note that no one selected situation A.

6.2.3.9 Housing

The respondents were asked about the *housing* aspect of the organization they represent, the following breakdown shows their replies.

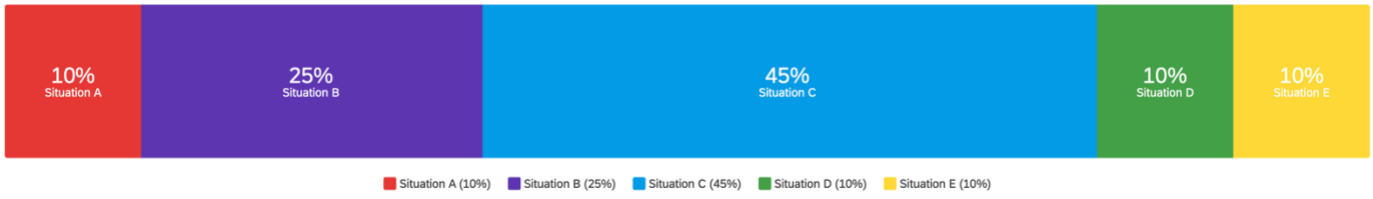


Figure 28 Survey Breakdown, Social Sustainability - Housing

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 45%), after which situation B (Do What Pays Now, 25%) was picked most, followed by situations A (Do Nothing 10%), D (Do Mission Zero, 10%) and E (Do Generative/Distributive, 10%).

6.2.3.10 Networks

The respondents were asked about the *networks* aspect of the organization they represent, the following breakdown shows their replies.

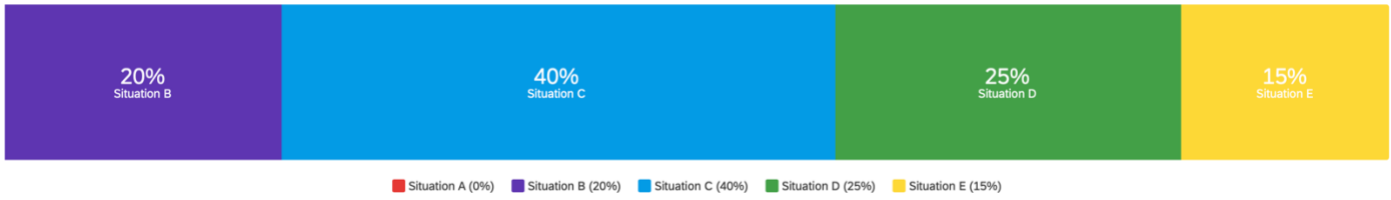


Figure 29 Survey Breakdown, Social Sustainability - Networks

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 40%), after which situation D (Do Mission Zero, 25%) was picked most, followed by situation B (Do What Pays Now, 20%).

It is of note that no one selected situation A.

6.2.3.11 Energy

The respondents were asked about the *energy* aspect of the organization they represent, the following breakdown shows their replies.

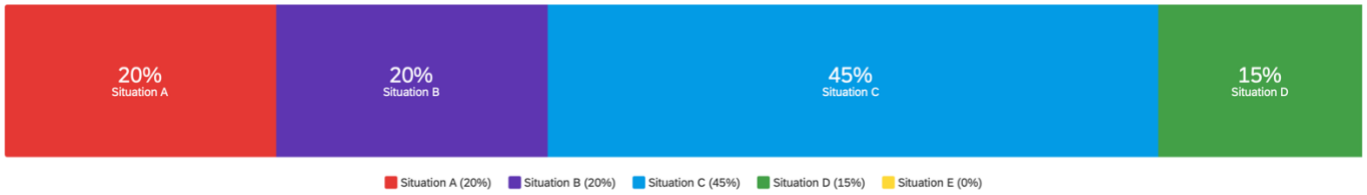


Figure 30 Survey Breakdown, Social Sustainability - Energy

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 45%), after which situation B (Do What Pays Now, 20%) and A (Do Nothing, 20%) were picked most.

6.2.3.12 Water and Sanitation

The respondents were asked about the *water and sanitation* aspect of the organization they represent, the following breakdown shows their replies.

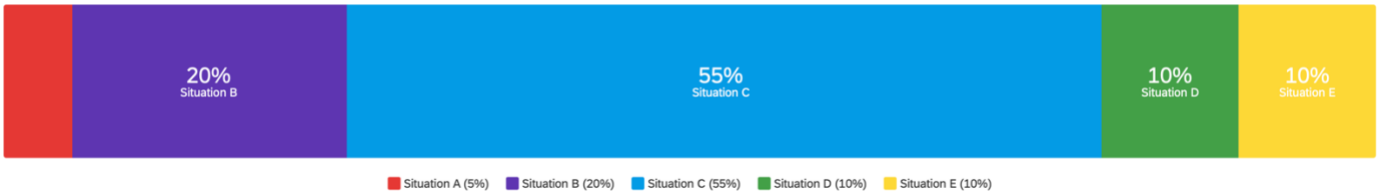


Figure 31 Survey Breakdown, Social Sustainability - Water and Sanitation

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 55%), after which situation B (Do What Pays Now, 20%) was picked most, followed by situation D (Do Mission Zero, 10%) and E (Do Generative/Distributive, 10%).

6.2.4 Results Survey - Ecological Sustainability

The third of three sustainability elements that will be treated is Ecological Sustainability.

The average score per question has been calculated:

Aspect	Average Score
Climate Change	2.3
Ocean Acidification	2.3
Ozone Layer Depletion	1.9
Nitrogen & Phosphorus Loading	1.65
Freshwater Withdrawals	2.25
Land Conversion	1.8
Biodiversity Loss	2.1
Average	**2.04** -> B (Do What Pays Now)

Table 33 Ecological Sustainability Average Score

6.2.4.1 Climate Change and Ocean Acidification

The respondents were asked about the *water and sanitation* aspect of the organization they represent, the following breakdown shows their replies.

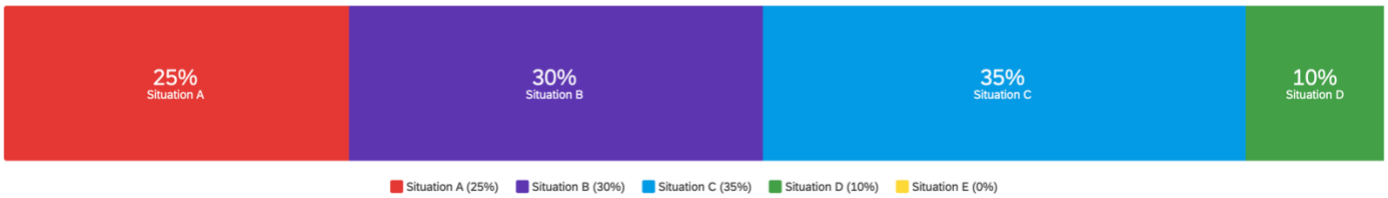


Figure 32 Survey Breakdown, Ecological Sustainability - Climate Change & Ocean Acidification

Here we can see the largest percentage of respondents picked situation C (maturity level: Do Your Fair Share, 35%), after which situation B (Do What Pays Now, 30%) was picked most, followed by situation A (Do Nothing, 25%).

It is of note that no one selected situation E.

6.2.4.2 Ozone Layer Depletion

The respondents were asked about the *ozone layer depletion* aspect of the organization they represent, the following breakdown shows their replies.

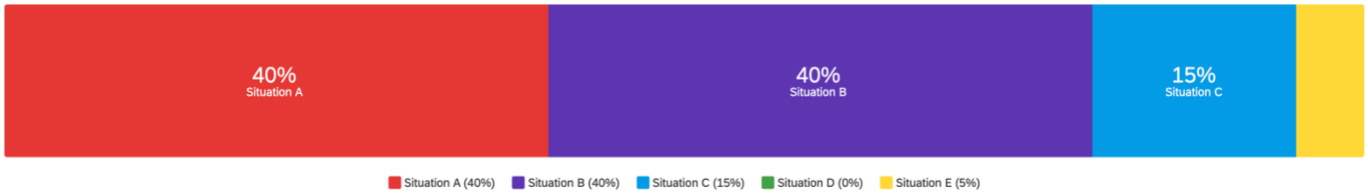


Figure 33 Survey Breakdown, Ecological Sustainability - Ozone Layer Depletion

Here we can see the largest percentage of respondents picked situations A (Maturity level: Do Nothing, 40%) and B (Do What Pays Now, 40%) were picked most, followed by situation C (Do Your Fair Share, 15%).

It is of note that no one selected situation D.

6.2.4.3 Nitrogen & Phosphorus Loading

The respondents were asked about the *nitrogen & phosphorus loading* aspect of the organization they represent, the following breakdown shows their replies.

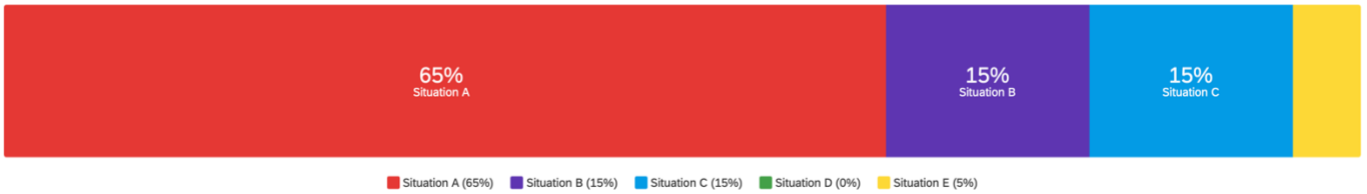


Figure 34 Survey Breakdown, Ecological Sustainability - Nitrogen & Phosphorus Loading

Here we can see the largest percentage of respondents picked situation A (maturity level: Do Nothing, 65%), after which situation B (Do What Pays Now, 15%) and C (Do Your Fair Share, 15%) were picked most, followed by situation A (Do Nothing, 25%).

It is of note that no one selected situation D.

6.2.4.4 Freshwater Withdrawals

The respondents were asked about the *freshwater withdrawals* aspect of the organization they represent, the following breakdown shows their replies.

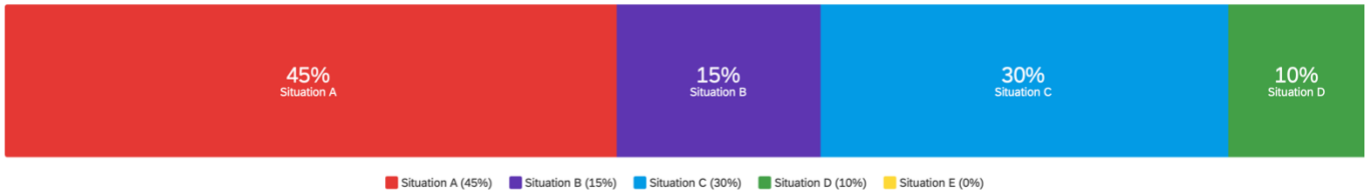


Figure 35 Survey Breakdown, Ecological Sustainability - Freshwater Withdrawals

Here we can see the largest percentage of respondents picked situation A (maturity level: Do Nothing, 45%), after which situation C (Do Your Fair Share, 30%), followed by situation B (Do What Pays Now, 15%) were picked most.

It is of note that no one selected situation E.

6.2.4.5 Land Conversion

The respondents were asked about the *land conversion* aspect of the organization they represent, the following breakdown shows their replies.

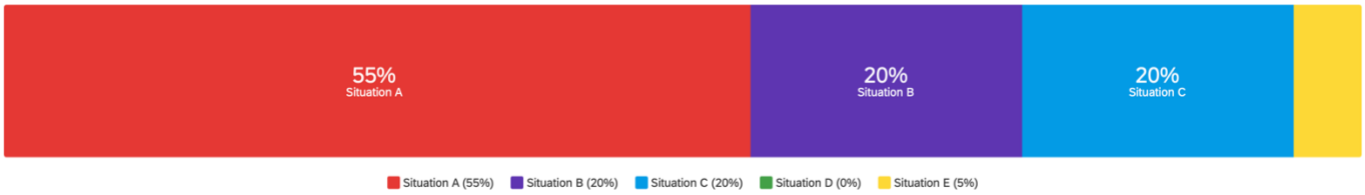


Figure 36 Survey Breakdown, Ecological Sustainability - Land Conversion

Here we can see the largest percentage of respondents picked situation A (maturity level: Do Nothing, 55%), after which situation B (Do What Pays Now, 20%) and C (Do Your Fair Share, 15%) were picked most.

It is of note that no one selected situation D.

6.2.4.6 Biodiversity Loss

The respondents were asked about the *biodiversity loss* aspect of the organization they represent, the following breakdown shows their replies.

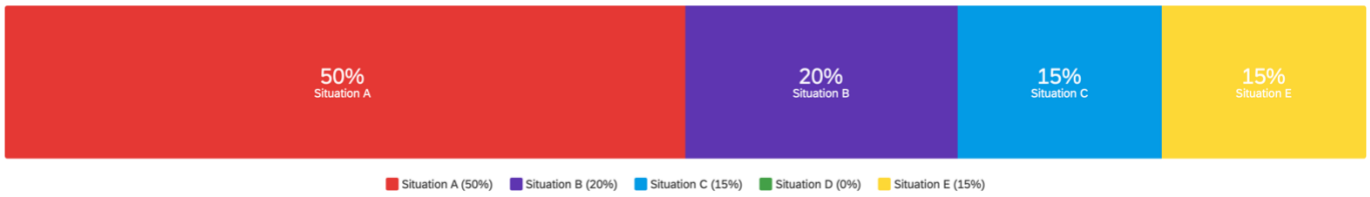


Figure 37 Survey Breakdown, Ecological Sustainability - Biodiversity Loss

Here we can see the largest percentage of respondents picked situation A (maturity level: Do Nothing, 50%), after which situation B (Do What Pays Now, 30%), followed by situation C (Do Your Fair Share, 15%) and E (Do generative/Distributive, 15%) were picked most.

It is of note that no one selected situation D.

6.2.5 Results Survey - Visualization

6.2.5.1 Overall score visualization

The overall visualization of the average outcome of the survey is.

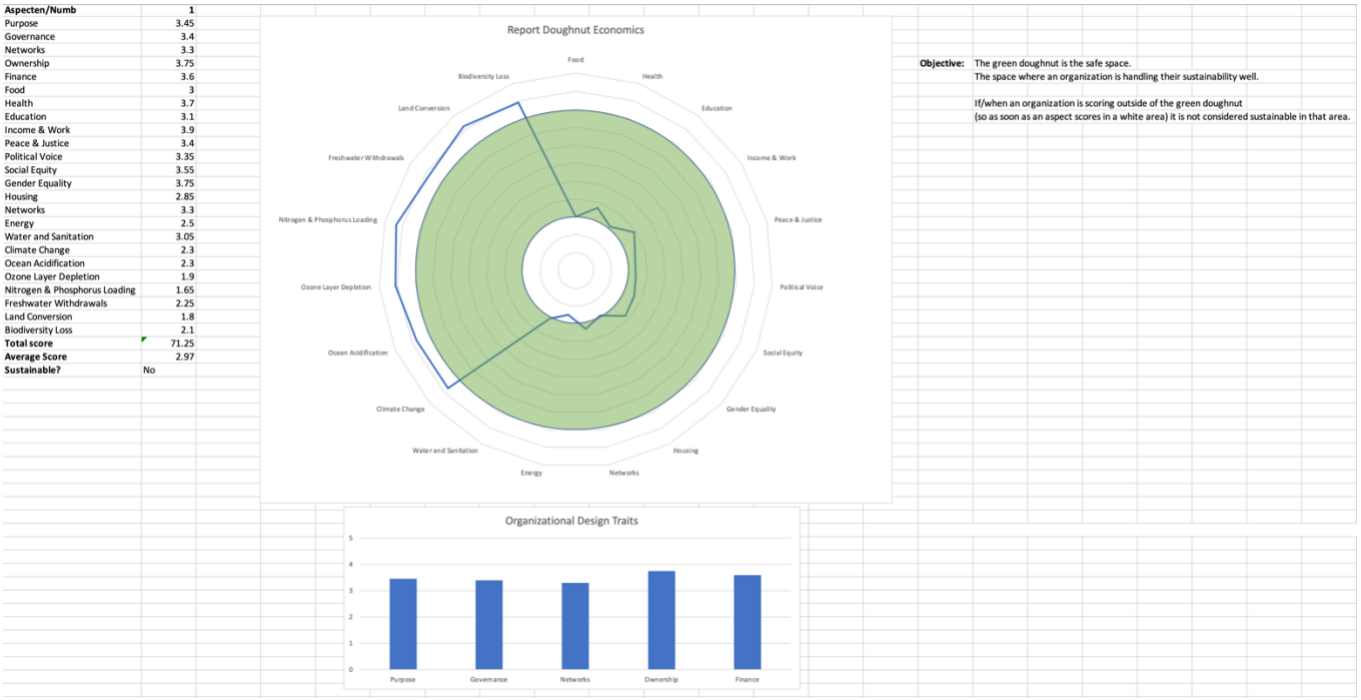


Figure 38 Overall Score Visualization

As seen here, the absolute organizational score can be seen on the left whilst the visualizations can be seen in the center and a short explanation of that visualization can be seen on the right. As this is a study around the subject of Doughnut Economics a doughnut diagram (made from a radar chart with multiple data inputs) was constructed.

6.2.5.2 *Individual score visualization*

The respondents who filled out the survey had the option to leave their email address, after which they would receive a visualized score and short analysis of their sustainability. There were 4 people who left their email.

One of these visualizations will be included here, the other 3 will be included in the appendix.

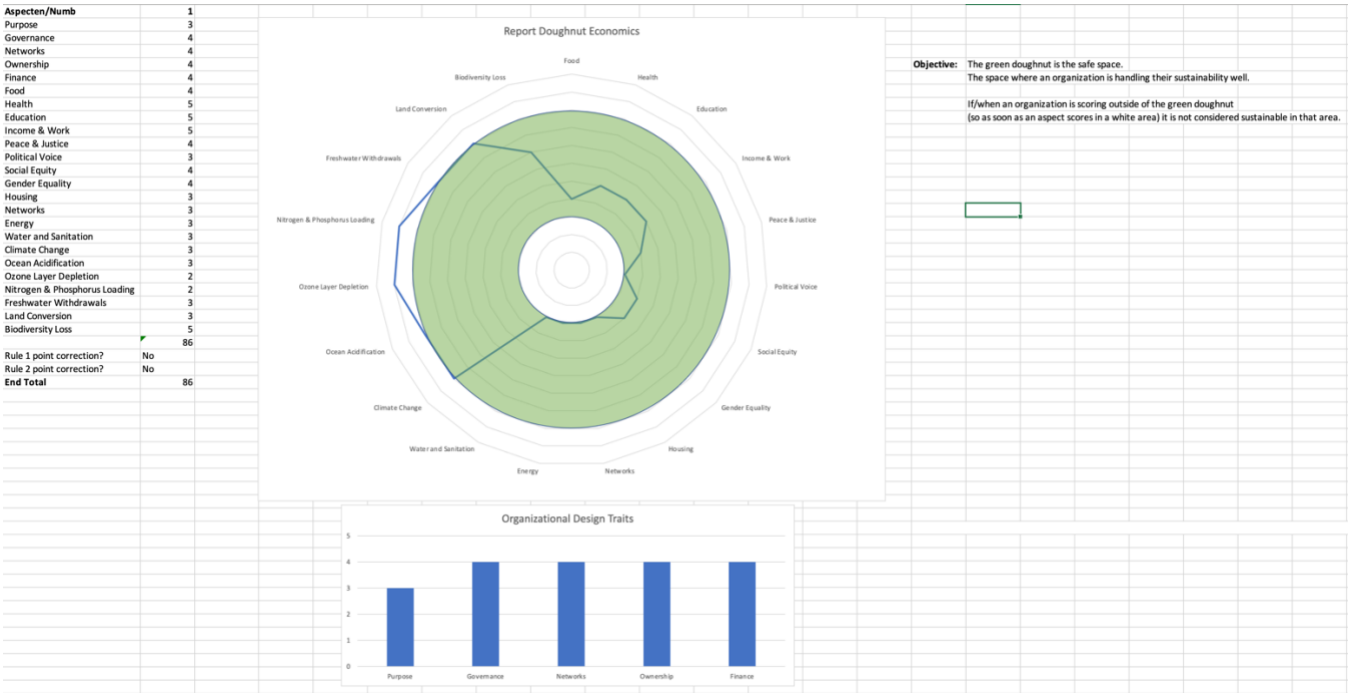


Figure 39 Individual Score Visualization

As seen here, the absolute organizational score can be seen on the left whilst the visualizations can be seen in the center and a short explanation of that visualization can be seen on the right. As this is a study around the subject of Doughnut Economics a doughnut diagram (made from a radar chart with multiple data inputs) was constructed.

6.2.6 Results Survey - Average Score

Before answers to specific questions are handled, the individual scores are shown, and an average score is calculated.

Org #	Score
1	86
2	113
3	77
4	83
5	53
6	65
7	50
8	80
9	81
10	98
11	70
12	64
13	74
14	63
15	59
16	57
17	54
18	53
19	71
20	73
Average	*71.2*

Table 34 Overall Average Score Organizations

Size	Average Score
Micro	56.5
Small	58.5
Medium	60
Substantial	59
Large	86
Very Large	75

Table 35 Average Score per Organization Size

Aspect	Average Score
Purpose	3.45
Governance	3.4
Networks	3.3
Ownership	3.75
Finance	3.6
Food	3
Health	3.7
Education	3.1
Income & Work	3.9
Peace & Justice	3.4
Political Voice	3.35
Social Equity	3.55
Gender Equality	3.75
Housing	2.85
Networks	3.3
Energy	2.5
Water and Sanitation	3.05
Climate Change	2.3
Ocean Acidification	2.25
Ozone Layer Depletion	1.9
Nitrogen & Phosphorus Loading	1.65
Freshwater Withdrawals	2.25
Land Conversion	1.8
Biodiversity Loss	2.1
Average	2.97 -> C (Do Your Fair Share)

Table 36 Overall Average Score Aspects

7 Analysis & Discussion

This chapter summarizes the major findings, outlines an overarching discussion and discusses the interpretation, implications and limitations based on those findings.

This research finds that Doughnut Economics can be downscaled to the IT-organizational level, as a model was achieved and refined by expert feedback. However, one of the findings is that there are some aspects of Doughnut Economics in which IT(-management) does not have a say, these are attributed to the organization itself and allow for integration of IT-organization sustainability into organizational sustainability in a larger sense. Another major finding is that ecological sustainability is lagging behind the social sustainability in the organizations that were researched. This can be seen in the average score of ecological sustainability (score: 2.04 - considered unsustainable, chapter 6.2.4) and social sustainability (score: 3.29 – considered sustainable, chapter 6.2.2), whilst organizations are on average well situated to achieve sustainability as seen by the average design traits score (score: 3.5 – considered sustainable, chapter 6.2.3).

7.1 Analysis

7.1.1 Analysis - Survey Outcome

In this sub-chapter the survey outcome is analyzed.

7.1.1.1 Overall analysis - Survey

As already stated in the summarized introduction of this chapter, the (IT-)organizations researched during this thesis have a lower average score on ecological- (score: 2.04, chapter 6.2.4) than social sustainability (score: 3.29, chapter 6.2.3). Looking at the average score of the design traits (score: 3.5, chapter 6.2.2) this might seem strange, since it seems organizations are (on average) well situated to reach sustainability and stay that way, but it does not need to be strange.

The Netherlands has a longstanding tradition of social sustainability in many ways and forms, it is and has been on the forefront of social sustainability and innovation (think of things like being the first country to legalize same sex marriage (Forbes, 2021) and the liberal prime-minister stating The Netherlands is -in its core- a deeply socialist country (Goslinga, 2020)).

The roots of the welfare state of The Netherlands come from a law introduced in 1854 by Thorbecke which officially laid the responsibility of relief for the poor at the doorstep of the church and private entities and made rules for this. However due to ongoing disagreement between aristocrats and democrats true social reform was not made until the end of the 19th century. In 1889 the first labor law is born in which measures against abuse of employees are recorded. The social element is one at which The Netherlands has excelled for a long time and feels comfortable with. (infoteur, n.d.)

The opposite is true for ecological sustainability, until recently this element was largely overlooked and ignored by most organizations, by some the science was outright denied. (Maslin, 2019) (Inter)National laws, policy, rules and guidelines are only just beginning to take form (there have of course been some initiatives, but these have been small in nature, limited to very tight parameters and have had variable rates of success. A large-scale, coordinated, (inter)national effort in the field of 'overall' sustainability is only just taking form, as an example one could think of the climate accord (Ministerie van Economische Zaken en Klimaat, 2019)).

This (partly) explains why ecological sustainability in the IT-organizations analyzed within this research is lagging behind social sustainability since these are all organizations within The Netherlands (although the behavior of denial when it comes to ecological harm and need for sustainability is definitely not exclusive to The Netherlands and can be seen in many if not most countries). The time this form of sustainability has been taken seriously is a lot shorter and has received a lot of skepticism over the years, but it is here to stay as younger generations feel this is an important subject (De Grote Vragen, 2018). It means, however, that in order for these (IT-)organizations to meet the goals of the climate accord (or a higher goal: to become sustainable) more effort needs to be spent on ecological sustainability.

This is also confirmed when looking at previous research performed by the university of Leeds (see figure 40).

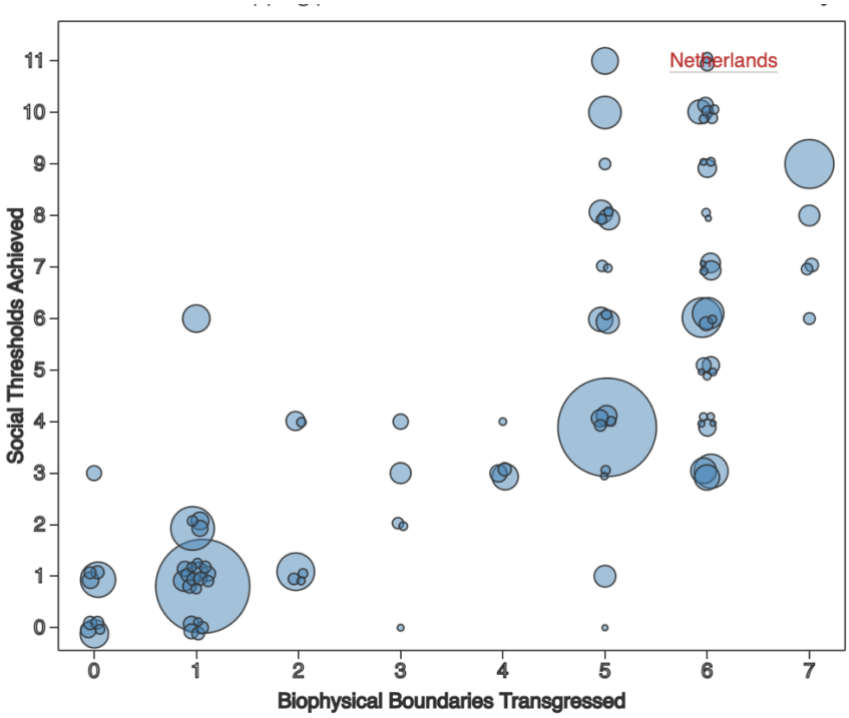


Figure 40 Transgressed Biophysical Boundaries vs Social Thresholds Achieved (O'neill, Fanning, Lamb, & Steinberger, 2018)

Here it can be seen that according to this research The Netherlands transgresses 6 out of 7 biophysical boundaries (what is called the Ecological Element in this thesis) while achieving 11 social thresholds (which are all social thresholds analyzed in that research). This shows a general

trend (worldwide, so also for The Netherlands) which is also shown in this research (namely: Ecological sustainability is lagging behind social sustainability).

Looking at the average (IT-)organization score (score: 71.3, chapter 6.2.6. Results Survey - Average Score) this falls in the lower echelons of the maturity level "Do Your Fair Share" which means it falls in the "Attempting to do Your Fair Share" range. This means that on average the (IT-)organizations analyzed in this thesis are not deemed sustainable, as mentioned this is mostly due to the lagging ecological sustainability. However, there is some distinction to be made here, smaller organizations analyzed during this thesis seem to do worse on sustainability than large ones.

As seen in the table, the average score of the largest 2 organizational forms (Large and Very Large) have a substantially higher sustainability score than their smaller counterparts, meaning that within this research it is found that larger organizations are more sustainable on average. An explanation for this might be (external) pressure (from government(s)) as well as interest groups and the ability to assign larger funds and amounts of time to address the issue.

Size	Average Score
Micro	56.5
Small	58.5
Medium	60
Substantial	59
Large	86
Very Large	75

Table 37 Average Score per Organization Size

7.1.1.2 Specifics

In this sub-chapter the interpretation per aspect of the Design Traits and Doughnut Economics is broken down. This can be found in Appendix VII.

7.1.1.3 Visualization

The visualization of the scores of individual organizations as well as the visualization of overall average score per aspect led to quite some brain-racking. Making a Doughnut-shaped graph that in some way resembles the famous Doughnut image was not as easy as expected.

In the end the visualization looks quite familiar, however one point that feels unsatisfactory is that adding the axis values did not work out, they just kept stating 0 to 11 whilst there should be 2 that range from 1 to 5. One that radiates outward (ecological aspects) from the center of the green doughnut and one that radiates inward (social aspects) from the center of the green doughnut

This means it becomes more difficult to see the exact score of each aspect in the radar chart, however this was made more bearable by 2 things:

1. The fact that the absolute scores per aspect are visible on the left
2. The fact that the quick explanation on the right tells you to look at whether the aspect scores in the white (considered unsustainable) or in the green doughnut (considered sustainable)

More on this in future research.

7.1.1.4 Difficulty of Survey

In this research the choice was made to use a survey filled with information from different fields and studies, leading to a survey that really needs experience with and knowledge of different subjects and areas of expertise. This means that it is difficult to find the right people to fill out this type of survey.

Because it is so difficult to find the right people, in the future it might be a necessity to use an organization with expertise in statistics and finding the right people within organizations like for example the CBS (the Dutch central bureau of statistics). These kinds of organizations have a large database of willing participants (people/organizations often gathered around previously established subjects, who could form a panel), would be more inclined to take part and possibly even be (financially) rewarded/motivated to do so.

The fact that it is difficult to find people with the right knowledge within organizations also shows that on the subject of sustainability there is still a lot to be gained in The Netherlands as it is apparent (when following this logic) that a lot of people did not fill out/complete the survey because they just did not have the knowledge to do so properly, or it took to long for them to obtain the information/knowledge needed.

In light of the urgency of the problem this is something that should be addressed, one could think of educational institutions adjusting curriculum as well as governmental intervention and organizational awareness.

7.1.2 Analysis - The Model

In the previous sub-chapter, the individual design traits and aspects of Doughnut Economics were individually discussed and compared, from this one can see 7 aspects which show a deviation from results from a different previous study done by the university of Leeds.

The reasons for this could lie in a few things:

1. As stated, this thesis downscales the Doughnut Economics model and applies it to IT-organizations. That means the indicators are different and more elaborate. It does not seem unlikely that this influences the outcome whilst still talking about/analyzing the same aspects and abstract subjects.
2. This research has a smaller sample size, this (in general) leads to a smaller degree of accuracy (large trends can still be seen but exact comparisons are difficult if not impossible). More on this later.

The 7 aspects with a deviation when compared that were mentioned earlier are:

1. Food - In this research the average organizational score of this aspect is on the threshold (so either just sustainable or just not) whilst in research performed by the university of Leeds this aspect scores as what we would consider sustainable
2. Education - Both studies (Leeds and this) find this aspect is what we would define as sustainable but with varying degrees of sustainability
3. Energy - This is quite a big deviation; the energy aspect is found sustainable in the Leeds study whilst in this study it is found as one of the lowest scoring social sustainability aspects and considered not sustainable
4. Climate Change - Although the general sentiment corresponds in both studies (not sustainable), the result in this study, coming from the sample of organizations is more positive than the result from the Leeds study
5. Freshwater Withdrawal - Not considered sustainable in this research (although one of the higher scoring aspects in the ecological sustainability element), considered the only sustainable ecological aspect in the Leeds study
6. Land Conversion - Same general sentiment (unsustainable) but rated more unsustainable in this research than that of the university of Leeds
7. Biodiversity Loss - Same general sentiment (unsustainable) but rated more unsustainable in this research than that of the university of Leeds.

In further research these aspects could be looked at first, since a deviation from earlier research was established here (although general trends/sentiment do often match).

The developer of this model sees this as a first step towards a wider model or framework that operates on different levels of an organization (Strategic, Tactical and Operational) which (dependent on in which of these organizational levels it is implemented/used) integrates (the strength of) different models and requirements.

7.1.3 Analysis - The Survey

The diversification of the survey towards target audiences is something that will also have to be looked at, meaning that currently the language and required set of knowledge is not geared towards a very diverse audience. This is wanted because of three reasons:

1. When more people know about (the need for) sustainability, it is likely sustainability will be reached more quickly (If the knowledge is not present, one cannot act on it)
2. When more people within more diverse groups know about sustainability, it is likely sustainability will be reached more quickly
3. It is difficult to reach just one group of people (especially when really looking for a small group inside an already small group).

This could be done by broadening the scope of the model outside of the IT-scope and reevaluating different requirements or by adjusting language used so other groups feel more included.

7.1.4 Analysis - The Sample

When looking at the sample currently analyzed (20 organizations), this is too small to generalize to the entire country (The Netherlands). Whilst accurate enough to determine whether the model works this means the result of the study cannot be generalized.

Having said that, it is desirable to be able to generalize results and thereby sketch an average image of how The Netherlands is doing on organizational IT-sustainability. This is (part of) what the model can do, it would be a shame not to do it!

Subsequently, a next step could be including an organization with experience and skill in the area of research, statistics and finding organizations and people within those organizations like the CBS (Dutch Central Bureau of Statistics).

7.1.5 Analysis - The Interviews

The results of the confirmatory research in the form of interviews are input for an improved model that allows for analysis of organizational, sustainable IT. This input has already been applied to the model and the updated model has been executed by ways of a survey that was filled out 20 times, more on the survey result in the next sub-chapter.

This means that it is possible to downscale Doughnut Economics to the IT-organizational level and integrate it into organizational sustainability in a larger sense. The reason for this being because experts on subset-subjects of the model (Ecological Sustainability, Social Sustainability, Maturity Model and Doughnut Economics) verified the model is good, pointed out where its flaws or weaknesses lay and what possible fixes there were, these were recorded in the results and findings chapter and included in the model.

Another point is that looking at earlier research the general trends the previous research uncovered are also found in this research (with the notable exception of 2 out of 7 aspects that deviate the most, namely: Energy & Freshwater Withdrawals, more on that in chapter 7.2.2).

7.2 Discussion

7.2.1 Response

From the start, this research was set up as a two phased study in which the measurement instrument was first constructed (phase 1) before the model would be used to make a baseline measurement of IT-sustainability in The Netherlands by means of a survey (phase 2). However, during phase 2 there was a challenge that proved impossible to overcome in the context and (time)constraints of this thesis, namely: *Too few respondents to generalize the findings*.

This changed the thesis outcome from mostly sketching a picture of a larger population (The Netherlands) by generalizing findings from enough respondents to proving the utility of the newly constructed model (also supported by the survey outcome which is compared to other studies involving Doughnut Economics).

Now, having said that it is obvious that the study did not obtain enough respondents for a sample that is generalizable to The Netherlands, however (trying) to achieve a sample should still be the aim of future research when aiming to generalize findings to The Netherlands using this model. The strategy and tactics of achieving that sample might differ though, having experienced first-hand that it is difficult to find a large number of respondents at the intersection of sustainability and IT. A solution for this could be involving an organization with expertise in the area of (such) research and has the connections for it (like the CBS, Dutch Central Bureau of Statistics). Another might be to better invest into snowball sampling (which is advised for use when dealing with hard-to-reach groups) by approaching all respondents for this (Shantikumar, 2018).

7.2.2 Suitability of the Doughnut Model

This brings us to the question *whether or not Doughnut Economics is suitable as a starting point for a sustainability assessment model for IT-Organizations in the first place*? To this, there are no simple answers. Having said that, there are a few things that make a good case for Doughnut Economics to be used for this sustainability assessment model for IT-organizations, namely:

(1) It being a fairly broad model, so many if not all known elements of both ecological and social sustainability are represented, this is important because to be able to be sustainable one needs to analyze all aspects of sustainability before action can be taken. (2) The interaction between social and ecological sustainability is captured in the model, meaning it (Doughnut Economics) understands and captures that ecological theory can only provide useful answers to the global ecological crisis if it is combined with social theory, and vice versa, while also understanding that we need to realize a change in the way of thinking about economic principles. This interaction is needed in every fiber of humanity's existence on this planet, including IT. (3) Doughnut Economics lends itself well to downscaling (although it had not been done in the same manner as done in this research at the time of writing) and downscaling it to the level of the IT-Organization allows for a more detailed breakdown of sustainability as well as incorporation in organizational sustainability in the form of an organization-wide Doughnut.

But there are also a few things which make using Doughnut Economics for a sustainability assessment model for IT-organization more difficult, namely:

(1) While also being one of its strengths, the broadness of the model is also something that can make it more difficult to apply this model to the IT-Organization because some aspects of Doughnut Economics are not areas that IT has an effect on or a say in (for example: Food, the IT-organization does not have anything to do with this, this is more facility management). However, having said that, for anchoring and the incorporation of the IT-organization's sustainability analysis into the overarching organization it is important to know the results of even these aspects from all departments to achieve a full organizational picture. (2) Another difficulty is the operating level; Doughnut Economics was initially intended to operate at the global level and has aspects that are defined according to this initial intent. This is however surmountable by using conceptualization theory to identify the underlying concepts of each aspect and apply those to the new level (the IT-organization in this case).

When looking at just the IT-Organization, not all aspects of Doughnut Economics are ones that the IT-organization has an effect on. This study could have decided to identify those aspects which always (only) apply only to the IT-organization and only use those for the model. However, when also looking at anchoring and incorporation into the sustainability of the entire organization this seemed unwise and was therefore not done, many Doughnuts (one for each department of the overarching organization) can (easily) be gathered into a single Doughnut. And all information and input is important to achieve a good overview. In the end, using a different model as a starting point for a sustainability assessment model just does not make sense when considering the interaction between social- and ecological sustainability to be extremely important, unless a different model also includes this and is still as thorough as Doughnut Economics is.

7.2.3 Suitability of the Developed Model

This leads us to a related subject; *the strengths and weaknesses of the IT-applied Doughnut Economics Model* (the model constructed in this thesis, for more on the model see chapter 4, starting from page 40). Comparing this to the global Doughnut Economics model, one can see that the main structure remains upright but definitions, requirements etc. have been changed (with the aid of conceptualization theory) to form a model that is better applied to the IT-organization while still being able to integrate with a larger doughnut to enable organization-wide sustainability integration while also allowing for individual breakdowns per department (in this case the IT-department).

Earlier on, it was already stated that this is a related subject when looking at the previous subject (using the global Doughnut Economics model as a starting point), in this case meaning that the outcomes are quite similar. The greatest strength of the IT-applied model is that its requirements and language are more suited to the IT-organization at a policy level. And a weakness (which is also still a strength) comes from its broadness, meaning that there are so many aspects, and some do not (always) apply to IT or are not aspects that IT has any effect on. This might seem to some as not important and it might also mean it is more difficult to answer questions (as it is difficult

to answer questions in areas one does not usually operate in or think of). This led to thinking at least some of these aspects needed to be removed, however it is also true that in order to be integrated into a larger (organization-wide) sustainability effort these aspects and input from any department should not be omitted. This leads to this study downscaling all aspects, in future research this consideration can be revisited.

7.2.4 Downscaling

In the previous paragraph(s) *downscaling* was already quickly mentioned, this was done using conceptualization theory (basically drawing concepts out of theory and applying those concepts in a different setting) as well as applying the four lenses of the existing Municipality of Amsterdam's Doughnut Economics implementation strategy (these four lenses are social, ecological, local and global, these were included in the model, but this could be explained more clearly). This could have been done more methodical with identified concepts being clearly displayed and presented to the experts (interviews) before being worked out as to achieve some clarity (judgement by experts) beforehand and displaying the incorporation of the four lenses more clearly.

7.2.5 Discussion in a Nutshell

This leads to the question of *whether the model has proven itself applicable to IT-organizations*. First, it is important to note the model was submitted to five experts who delivered feedback. Important feedback was worked into the model, the initial plan was to have another round of interviews after this to confirm the feedback had been properly introduced into the model and to confirm there was no additional feedback. However, this was not done due to the (time)constraints of the thesis as well as the limited availability of some of the experts.

This study was also presented at Groene Peper, an event about sustainability in higher education in the Netherlands, and received praise from the quartermaster of the Amsterdam Doughnut Coalition who said he was "impressed by the methodical approach, to localizing or downscaling the Doughnut" and that "The ambition of localizing or downscaling the Doughnut is something that was identified very cleverly". (Groene Peper, 2021)

Now, when comparing the outcome of the survey to previous research performed by the University of Leeds one can see 7 aspects which show a deviation from this research (see the analysis subchapter). Most (5) of these are smaller deviations that agree with the general trend set by the Leeds study and can be explained by sample size bias and/or the time difference between the studies. There are however also two aspects (Food and Freshwater Withdrawals) which show a bigger deviation. This could be because this thesis downscales the Doughnut Economics model and applies it to IT-organizations. That means the indicators are different and more elaborate. It does not seem unlikely that this influences the outcome whilst still talking about/analyzing the same aspects and abstract subjects.

Another point here is the difficulty of the survey, and although there are no official recordings of this, some people did indicate the survey was quite difficult to answer, which could mean that

reaching the goal of being applicable is more difficult. This is likely due to the previously mentioned "broadness" of the model (meaning it includes a wide spectrum of social and ecological aspects) as well as limiting itself to the policy level. This could mean that the application of the model (by way of the survey) is difficult for organizations to do for large parts of the target-group within the organizations (IT-managers / IT-staff and even in combination with a sustainability/green office). It seems like there is knowledge about more conventional sustainability when applied to an organization, but not so much on the subject of (organizational) IT, which is interesting. However, according to this research it is very necessary that a broad sustainability model that combines social- and ecological sustainability is introduced into (IT-)organizations to become sustainable in the (near) future. Therefore, this does not mean the difficulty of the model or survey is too high, but it means the knowledgebase and mindset in organizations is not where it needs to be.

This is also a point of feedback that was made by interviewee #4, who stated that the mindset surrounding IT and IT-personnel is a mindset of keeping IT operational and functional while efficiently solving the customer's problem, everything else comes second. This means that knowledge and expertise up until now has been mainly focused on continuous, smooth operation and not so much sustainability, this needs to change. It is, however, not only for-profit organizations who are guilty of this, but it is something that has seeped into IT-culture and thereby all IT-organizations and needs to be rooted out. This research finds there is also a place for educational institutions here, as there is currently very little (if any) emphasis on sustainability in educational life I have experienced.

There are some ifs and buts, and future research could focus on the 2 deviating aspects to explain the deviation, but overall, the model does what it is intended to do and does so well.

In previous paragraphs some *procedural* items already came up as an element of the main subject talked about in that paragraph, however, I will treat these again. Looking back, it might have been more prudent to plan more time or allow for more leeway in planning for all the "social interaction" parts of this thesis (these parts are finding and interviewing interviewees and respondents for the survey) as this is where a lot of delays took place which resulted in more stress later on as well as not being able to confirm the model changes through a 2nd interview.

7.3 Limitations – Threats to Validity

The first and foremost limitation of this research is that it is not possible to generalize the results due to the limited number of participants (20). Whilst the amount needed to be generalizable to the Netherlands would be: 370 (although theory differs on the needed amount). (Checkmarket, n.d.)

The model design and research were conducted in the Netherlands (on IT-organizations operating in the Netherlands) and executed by a Dutch civilian. That means the culture and values of Dutch society play a role in this study.

Another limitation is that due to the limited time for evaluation of the Doughnut Economics model (theory around Doughnut Economics was officially released in 2017) and the different level this was done at (the national level versus the IT-organizational level in this study) limited research was done and it is thereby sometimes difficult to compare results because the aspects and indicators differ while the underlying train(s) of thought and trends match.

There is always a degree of subjectivity to a survey, which means that something like *random bias* can never be completely ruled out. It can, however, be controlled. It is also likely there is *small sample size bias*, meaning that a small sized sample is taken and used to do analysis on, even with conservative (statistical) results being used this is a threat. Another limitation or threat is *referral bias* because these people often differ from people who were not referred to the survey. (Krishna, Maithreyi, & Surapaneni, 2010)

Unfortunately, there is a basic human tendency to present oneself as successful and the best version of what they can be, even though this might not be truthful to the situation. This can significantly impact research. (Fisher, 1993)

The survey questions were posed on a 5-point Likert scale, meaning there might be a central tendency bias, which means there is a tendency to place most items in the middle of the scale. (Statistics How To, 2016)

Based on the amount of time left, the amount of work and the availability of (some) of the people interviewed it was decided not to do a second iteration of the interviews, here things could have been double-checked and misunderstandings or questions could have been identified. The number of interviewees was limited to 5 to keep the amount of feedback to a workable amount (more than 100 pages of interview were already transcribed).

There is also the possibility of a sampling bias due to using the network of one of the supervisors to reach experts to validate the model. (Catalogue of Bias, 2017)

8 Conclusions

This research aimed to discern whether Doughnut Economics could be used as a basis for developing an assessment model for IT-organizations in The Netherlands, whether this model could be made manageable and executable for these IT-organizations, test the usability of that model on a sample of IT-organizations in The Netherlands, draw a conclusion about the possible usability of the model for representative research in The Netherlands and find indications for possible future research from test results. The main research question being:

> *Can Doughnut Economics be downscaled to IT-organizational size, integrated into organizational level sustainability in a larger sense and used to sketch an image of the organizations' IT-sustainability?*

The research was done by loosely following a design science approach to developing research instruments. First a model was constructed and evaluated by experts on important sub-areas of a sustainability model (Social sustainability, Ecological sustainability, Maturity Models and Doughnut Economics). Feedback was analyzed and -if/when found useful- integrated into the model.

To make the model manageable and executable for IT-organizations a survey to assess organizational IT sustainability was developed which gathered information on a sample of 20 IT-organizations in The Netherlands to test the usability. These respondents were gathered using private connections and channels as well as the professional network of the organization supervisor, taking part in an event around sustainability in higher education called Groene Peper and being included and highlighted in their media coverage/campaign of the event.

The data procured (from that sample of 20 IT-organizations) in the survey shows an average score of 3.5 out of 5 on Design Traits (which indicate whether an organization can operate sustainably or whether this is going to be troublesome), 3.29 out of 5 on social sustainability and 2.04 on ecological sustainability. This indicates that in the sample ecological sustainability is lagging behind social sustainability, whilst organizations are well positioned to be sustainable/operate sustainably. This sentiment is also mirrored in earlier (doughnut) research performed by the university of Leeds, which shows that on a national level The Netherlands is meeting social- but not ecological thresholds.

The conclusion of this research is (1) The assessment model for IT-organizations in The Netherlands lends itself well to analysing and mapping Organizational IT Sustainability on the policy level; (2) In the sample an average score of 2.04 out of 5 was reached on ecological sustainability amongst IT-organizations within The Netherlands, meaning they overshoot the ceiling and are not deemed ecological sustainable on average. An average score of 3.29 out of 5 was reached on social sustainability, this shows ecological sustainability in the sample is lagging behind social sustainability whilst organizations are on average well positioned to operate sustainably (average design trait score: 3.5 out of 5); (3) The integration with organizational level sustainability is definitely possible (Doughnuts can complement each other, multiple doughnuts

could make an overall organizational Doughnut). (4) Further representative research is needed and should come to a snapshot of The Netherlands's IT-sustainability.

8.1 Contributions

This research contributes to literature by doing research on a nouveau model in Economic Science and applying this to organizational IT. This (to the current knowledge) had not been done before, any (additional) research that had been done was either at the national or international level. There is an exception to this, as there is a municipality (Amsterdam) that has been introducing Doughnut Economics in its organization, but it does not release much more than its implementation strategy (whilst this research is not aimed at an implementation strategy but at achieving a model to analyze in order to be able to adjust policy).

By collecting and analyzing literature in the field of Doughnut Economics, Design Traits and supporting theories a model applying Doughnut Economics to organizational, sustainable IT could be created, verified and tested. When looking at the research motivation this means that this research has taken a step in the direction of solving issues such as sustainability and social issues being tackled as completely separate issues, while often they are connected. This study helps tackle the increasing rise of IT's 'unsustainability' by downscaling a model (Doughnut Economics) that was previously ill-suited to analyze any entity as small as a subset of an organization, to a model that can analyze organizational IT sustainability on the policy level. Another

8.2 Further research

During the writing and execution of this research 5 points that (could) require further research were identified.

8.2.1 Possibility of Apportionment Key

Because different industries, departments and different fields of work have a different base value (of for instance emissions) and impact on both ecological and social sustainability (For instance: A steel manufacturer has a higher base CO_2 emission value than an accountancy firm, because CO_2 emissions are just naturally higher when making steel). Further research into the benefit of implementing an apportionment key to divide the reduction of emissions and the increase in social foundations within industries and departments of organizations in such a manner that it is viable and proportionate to do so could be done.

Research into this subject should be split into 2 parts, namely:

1. Is this actually a good idea?
2. If the answer to the first question is "yes": What is a fair and achievable (for all sectors/people/organizations) apportionment key?

The ideas that come to mind for question #1 is:
During this research this question was already pondered slightly. And although never answered explicitly in this research before, the conclusion was reached that, for now, absolute numbers would be the best. This was done for a number of reasons:

1. The way to execute this research was cast into the form of a maturity model which was executed via a self-assessment by way of a survey. It is time-consuming and raises the difficulty level when respondents need to perform calculations, this deters them from completing the survey
2. There is the belief that there has been too much slack for organizations, for decades, when it comes to both ecological and social sustainability. There is no more wiggle room, now it is time to conform, these are the rules and values, abide by them or fade away.

The idea that comes to mind for question #2 for ecological sustainability is:
Use the base-value, calculated in this research, which every organization can emit per employee and use variables (such as: Base values per industry or department per aspect of Doughnut Economics, Business/department-size, cost of emission reduction and other variables that affect a fair and viable distribution of variable thresholds of the aspects) to come to a mathematical formula for fair and viable distribution of variable thresholds of the different aspects based on important variables.

8.2.2 Practical Implementation

This study has currently aimed to sketch a model on the policy level of the (IT-)organization, downscaled from a model that operates on the global level. As stated, these are both policy level models, having achieved that policy level, the question quickly becomes how to achieve the policies by practicalities, in other words: "We have the goals, now what do we do to achieve them?". This is an important question, and a lot of intelligent people have worked and are still working on answers to it.

Research combining the application of Doughnut Economics to Organizational Sustainable IT and its practicalities would benefit from composing a best practice guide to reach policy goals by defining what works well for different types, sizes (and possibly other important variables which would have to be established) of organizations within different industries (a one-size-fits-all approach might not be sufficient, what works for one organization does not necessarily work for another) in which there would be practical measures per aspect of Doughnut Economics per maturity level.

This could be done by mapping already known (practical implementation) models and certifications onto the aspects and maturity levels of the current model. Exactly which models are effective would have to be researched, however this study does have a few suggestions.

8.2.2.1 Mapping the Circularity Ladder onto the Maturity Levels

Circularity is an important factor of Doughnut Economics. The R-ladder which is based on the 10 R-principles (named that way because the 10 principles all start with the letter "R", multiple variations of this model exist, ranging anywhere from 6 to 10 R's) is a dominant model in The Netherlands' public institutions to measure and increase circularity and reduce linearity.

Research into improving the application of Doughnut Economics to Organizational Sustainable IT could benefit from mapping this R-ladder model onto the maturity levels of the "Applying Doughnut Economics to Organizational Sustainable IT" model, which would increase integrality, effectiveness and acceptance.

8.2.2.2 Mapping the CO_2 Performance Ladder onto the Climate Change aspect of Doughnut Economics

The CO_2 Performance Ladder and certification is a widely used tool to enhance performance in the field of lowering CO_2 emissions and in doing so countering climate change in The Netherlands.

Research into practical implementation of the CO_2 emission goals of the Doughnut Economics applied to organizational sustainable IT maturity model would benefit from mapping the CO_2 Performance Ladder onto the climate change aspect of Doughnut Economics and would increase acceptance in The Netherlands.

8.2.2.3 Include CO_2 emission rights system and maximum values for this in climate change chapter

There is currently an EU CO_2 emissions system in existence, this regulates the amount of CO_2 an organization can emit. Rules and regulations around this are also going to be reworked in the near future (there is an iteration of the EU Green New Deal coming in June or July of 2021). Including this system and unifying values calculated on CO_2 emissions in this research and this system would speed along acceptance and increase effectiveness and integrality both nationally and internationally (this point also contributes to the 1st suggestion of an apportionment key).

8.2.3 Attributing the difference between in-house and outsourced IT to organizations in this model

In this model there are no distinctions or regulations between organizations who have outsourced their IT and those who have kept their IT in-house. This means people who self-assess their organization with the survey that comes with the current study can interpret for themselves how they want to calculate/count certain emissions and/or social sustainability factors.

An example of this is: If an organization outsources their IT, they can say they don't have an IT department, so they don't emit any CO_2 in their IT. This is of course not true, but no limitations were set upon this within this research, it is left up to the interpretation of those answering the survey.

Research into this subject could benefit from looking at the total emissions of the IT-provider and then at how much of the total capacity of the IT-provider the customer-organizations take and attributing the percentage of capacity the customer-organizations take in emissions to the customer organization.

All aspects of Doughnut Economics should be taken into account for this.

8.2.4 Improved Visualization

Further improvement on the subject of visualization could be attempted. There could be 2 main points of focus: Either continue with the current radar chart made in excel and improve this to include an axis with the right numbers or have a graphical representation made by a graphical designer.

8.2.5 Make a representative snapshot of The Netherlands

One of the first steps towards sustainability is knowing how (and what) we are actually doing. This model can help in that respect but needs a representative sample to do so on a national level. Since it was found to be difficult to reach a large amount of people within IT-organizations who have the correct set of knowledge, a next step could be including an organization with experience and skill in the area of research, statistics and finding organizations and people within those organizations like the CBS (Dutch Central Bureau of Statistics) in future research.

9 Bibliography

Amsterdam Economic Board. (2021, March 5). *Omslag naar circulaire ICT inkoop moet afvalstapel drastisch inperken.* Retrieved from Amsterdam Economic Board: https://amsterdameconomicboard.com/nieuws/omslag-naar-circulaire-ict-inkoop-moet-afvalstapel-drastisch-inperken

Anthesis Group. (n.d.). *Achieving Net Zero*. Retrieved February 2021, from Anthesis Group: https://www.anthesisgroup.com/achieving-net-zero/

BBC. (2020, December). *Climate change: EU leaders set 55% target for CO2 emissions cut.* Retrieved from BBC: https://www.bbc.com/news/world-europe-55273004

BP. (2019, June). *Statistical Review of World Energy.* Retrieved from BP: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

Cagnin, C. H., Loveridge, D., & Butler, J. (2005). *Business Sustainability Maturity Model.* Retrieved from Crrconference: https://www.crrconference.org/Previous_conferences/downloads/cagnin.pdf?_ga=2.167864354.2009056991.1513296000-1263479451.1513296000

Cambridge Dictionary. (2021, January 21). *Sustainability*. Retrieved from Cambridge Dictionary: https://dictionary.cambridge.org/dictionary/english/sustainability

Camebridge Dictionary. (2021, February). *Affordability*. Retrieved from Camebridge Dictionary: https://dictionary.cambridge.org/dictionary/english/affordability

Camebridge Dictionary. (2021, February). *Equity*. Retrieved from Camebridge Dictionary: https://dictionary.cambridge.org/dictionary/english/equity

Camebridge Dictionary. (2021, February). *Living wage*. Retrieved from Camebridge Dictionary: https://dictionary.cambridge.org/dictionary/english/living-wage

Camebridge Dictionary. (2021, February). *Organization*. Retrieved from Camebridge Dictionary: https://dictionary.cambridge.org/dictionary/english/organization

Camebridge Dictionary. (2021, February). *Peace*. Retrieved from Camebridge Dictionary: https://dictionary.cambridge.org/dictionary/english/peace

Camebridge Dictionary. (2021, February). *Peace*. Retrieved from Camebridge Dictionary: https://dictionary.cambridge.org/dictionary/english/justice

Catalogue of Bias. (2017). *Selection bias.* Retrieved from Catalogue of Bias: https://catalogofbias.org/biases/selection-bias/

CBS. (2020, February). *Meer dan de helft werkt voltijds*. Retrieved from CBS: https://www.cbs.nl/nl-nl/nieuws/2020/08/meer-dan-de-helft-werkt-voltijds

Checkmarket. (n.d.). *Sample size calculator*. Retrieved from Checkmarket: https://www.checkmarket.com/sample-size-calculator/

Circulair. (n.d.). *Wat is een circulaire economie?* Retrieved April 2021, from Ciculair: https://circulair.com/wat-is-circulair/

Davis, G. B. (2000, January). *Information Systems Conceptual Foundations: Looking Backward and Forward.* Retrieved from Researchgate: https://www.researchgate.net/publication/220985029_Information_Systems_Conceptual_Foundations_Looking_Backward_and_Forward

De Grote Vragen. (2018, April 12). *Generatie Z meer bezig met duurzaamheid dan millenials?* Retrieved from De Grote Vragen: https://degrotevragen.nl/wetenschap/genz-bezig-duurzaamheid-millennials/

Esselink, W. (2020, September). *Stikstof- en fosfaatuitstoot veestapel gedaald.* Retrieved from FoodAgriBusiness: https://www.foodagribusiness.nl/stikstof-en-fosfaatuitstoot-veestapel-gedaald/

European Commission. (2016, February 24). *User guide to the SME Definition.* Retrieved from European Commission: https://ec.europa.eu/regional_policy/sources/conferences/state-aid/sme/smedefinitionguide_en.pdf

European Commission. (2020). *European Green New Deal.* Retrieved from European Commission: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

European Commission. (n.d.). *Causes of climate change*. Retrieved February 2021, from European Commission: https://ec.europa.eu/clima/change/causes_en

Fisher, R. J. (1993, September). *Social Desirability Bias and the Validity of Indirect Questioning.* Retrieved from JSTOR: https://www-jstor-org.ezproxy.leidenuniv.nl/stable/2489277

Flannery, T. (2015). *Atmosphere of Hope: Searching for Solution to the Climate Crisis.* Atlantic Monthly Press. Retrieved from Atmosphere of Hope: Searching for Solution to the Climate Crisis

Florida Tech. (n.d.). *Information Systems vs. Information Technology*. Retrieved from Florida Tech: https://www.floridatechonline.com/blog/information-technology/information-systems-vs-information-technology/

Food and Agriculture Organization of the United Nations. (2020). *The State of Food Security and Nutrition in the World.* Retrieved from Food and Agriculture Organization of the United Nations: http://www.fao.org/3/ca9692en/CA9692EN.pdf

Forbes. (2021, April 1). *The Netherlands Celebrates 20 Years Since Becoming The First Country To Legalize Same-Sex Marriage By Floating A Giant Pink Cake Down Amsterdam's Canals*. Retrieved from Forbes: https://www.forbes.com/sites/roberthart/2021/04/01/the-netherlands-celebrates-20-years-since-becoming-the-first-country-to-legalize-same-sex-marriage-by-floating-a-giant-pink-cake-down-amsterdams-canals/

Forbes. (n.d.). *Ten Signs You're Being Paid Fairly -- And Ten Signs You're Not*. Retrieved February 2021, from Forbes: https://www.forbes.com/sites/lizryan/2018/04/04/ten-signs-youre-being-paid-fairly-and-ten-signs-youre-not/?sh=7f6d5b6b69c3

Fowler, C., & Mayes, J. (1999). *Learning relationships from theory to design.* Retrieved February 2021, from Click4it: https://doi.org/10.1080/0968776990070302

Goslinga, H. (2020, April 5). *De spectaculaire bekering van Rutte*. Retrieved from Trouw: https://www.trouw.nl/nieuws/de-spectaculaire-bekering-van-rutte~bbeed69e/

Groene Peper. (2021, June 3). *The journey of the Amsterdam Doughnut Coalition and Sustainable ICT*. Retrieved from Youtube: https://www.youtube.com/watch?v=CeIktlvVCdw

infoteur. (n.d.). *De Nederlandse verzorgingsstaat: een beknopte geschiedenis*. Retrieved from Infonu: https://mens-en-samenleving.infonu.nl/politiek/187071-de-nederlandse-verzorgingsstaat-een-beknopte-geschiedenis.html

Investopedia. (2020, November). *Mode*. Retrieved from Investopedia: https://www.investopedia.com/terms/m/mode.asp

Kelly, M. (2012). *Owning Our Future: The Emerging Ownership Revolution.* Berrett-Koehler Publishers.

Kelly, M. (2013). *The Architecture of Enterprise: Redesigning Ownership for a Great Transition.* Retrieved from Jstor: https://www.jstor.org/stable/10.5325/goodsociety.22.1.0061

Kelly, M. (n.d.). *What is the generative economy?* Retrieved from bkconnection: https://www.bkconnection.com/bkblog/marjorie-kelly/what-is-the-generative-economy

Krishna, R., Maithreyi, R., & Surapaneni, K. M. (2010, April 5). *Research Bias: A Review For Medical Students.* Retrieved from Citeseerx: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.610.8597&rep=rep1&type=pdf

Large enterprise. (2020, November 16). Retrieved from Insee: https://www.insee.fr/en/metadonnees/definition/c1035

Levin, K., & Davis, C. (2019, September 17). *What Does "Net-Zero Emissions" Mean? 6 Common Questions, Answered*. Retrieved from World Resources Institute: https://www.wri.org/blog/2019/09/what-does-net-zero-emissions-mean-6-common-questions-answered

Lokrantz, & Azote. (n.d.). *Planetary Boundaries*. Retrieved from Stockholm Resilience: https://www.stockholmresilience.org/research/planetary-boundaries.html

Maslin, M. (2019, November 28). *The five corrupt pillars of climate change denial*. Retrieved from The Conversation: https://theconversation.com/the-five-corrupt-pillars-of-climate-change-denial-122893

McClaren, T., & Buijs, P. (2011). *A DESIGN SCIENCE APPROACH FOR DEVELOPING INFORMATION SYSTEMS RESEARCH INSTRUMENTS.* Retrieved from Rug: https://www.rug.nl/staff/p.buijs/design_science_approach_for_developing_isr_instruments.pdf

MedicalNewsToday. (2020, November). *What are some different types of gender identity?* Retrieved from MedicalNewsToday: https://www.medicalnewstoday.com/articles/types-of-gender-identity#definition-of-gender-identity

Ministerie van Economische Zaken en Klimaat. (2019, June 28). *Klimaatakkoord*. Retrieved from Klimaatakkoord.nl: https://www.klimaatakkoord.nl/klimaatakkoord

NASA. (2004). *NASA Ozone Watch*. Retrieved from National Aeronautical and Space Administration: https://ozonewatch.gsfc.nasa.gov/facts/hole_SH.html

National Oceanic and Atmospheric Administration. (2020, April). *Ocean acidification*. Retrieved from National Oceanic and Atmospheric Administration: https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification

Newman, D. (2014, April). *Experts May Have Influence, But What Makes An Expert?* Retrieved from Forbes: https://www.forbes.com/sites/danielnewman/2014/04/22/experts-may-have-influence-but-what-makes-an-expert/

Nunez, C. (2019, April). *Ozone depletion, explained*. Retrieved from National Geographic: https://www.nationalgeographic.com/environment/global-warming/ozone-depletion/

O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018, January). *Country Comparisons*. Retrieved from University of Leeds: https://goodlife.leeds.ac.uk/countries/#Netherlands

O'Neill, D., Fanning, A., Lamb, W., & Steinberger, J. (2018). A good life for all within planetary boundaries. *Nature Sustainability*, 88-95.

O'neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018, January). *A Good Life For All Within Planetary Boundaries*. Retrieved from University of Leeds: https://goodlife.leeds.ac.uk

Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. (1993, August). *Capability Maturity Model.* Retrieved from Researchgate: https://www.researchgate.net/publication/3246910_Capability_Maturity_Model_Version_11

PBL. (2020, August 04). *R-ladder meet circulariteit*. Retrieved from RVO: https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/circulaire-economie/r-ladder

Pearce, F. (2015, August). *Global Extinction Rates: Why Do Estimates Vary So Wildly?* Retrieved from Yale Environment 360: https://e360.yale.edu/features/global_extinction_rates_why_do_estimates_vary_so_wildly

Pinho, B. (2020, November 10). *Whatever Happened to the Hole in the Ozone Layer?* Retrieved from Discover Magazine: https://www.discovermagazine.com/environment/whatever-happened-to-the-hole-in-the-ozone-layer

Porter, M. E. (1985). *Competitive Advantage - Creating and sustaining superior performance.* Retrieved from Cloudfront: https://www.mindtools.com/pages/article/newSTR_66.htm

Provincies in Nederland. (n.d.). Retrieved February 2021, from Holland: https://www.holland.com/be_nl/toerisme/bestemmingen/provincies.htm

Raia, P., Mondanaro, A., Melchionna, M., Castiglione, S., Serio, C., & Rook, L. (2020, November). *Past Extinctions of Homo Species Coincided with Increased Vulnerability to Climatic Change.* Retrieved from Sciencedirect: https://www.sciencedirect.com/science/article/pii/S2590332220304760

Raworth, K. (2017). *Doughnut Economics - Seven ways to think like a 21st-Century Economist.* Random House Business Books.

Raworth, K. (2017). *What on Earth is the Doughnut?...* Retrieved from Kate Raworth: https://www.kateraworth.com/doughnut/

Raworth, K. (2017). *What on Earth is the Doughnut?…*. Retrieved from Kate Raworth: https://www.kateraworth.com/doughnut/

Raworth, K. (2018, August). *Can we do business in the doughnut economy?* Retrieved from Greenbiz: https://www.greenbiz.com/article/can-we-do-business-doughnut-economy

Raworth, K. (2020). Retrieved from Doughnut Economics: https://doughnuteconomics.org

Remkes, J., van Dijk, J., Dijkgraaf, E., Freriks, A., Gerbrandy, G., Maij, W., . . . Vet, L. (2020, Juni). *Niet alles kan overal.* Retrieved from Rijksoverheid: https://www.rijksoverheid.nl/documenten/rapporten/2020/06/08/niet-alles-kan-overal

Rijksoverheid. (n.d.). *Leerplicht en kwalificatieplicht*. Retrieved February 2021, from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/leerplicht/leerplicht-en-kwalificatieplicht

Rijksoverheid. (n.d.). *Minimumloon*. Retrieved February 2021, from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/minimumloon

Rijksoverheid. (n.d.). *Op hoeveel vakantiedagen heb ik recht?* Retrieved February 2021, from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/vakantiedagen-en-vakantiegeld/vraag-en-antwoord/op-hoeveel-vakantiedagen-heb-ik-recht

Rijksoverheid. (n.d.). *Zorgverzekering*. Retrieved February 2021, from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/zorgverzekering

Rockström, J., Steffen, W., Noone, K., Persson, A., Stuart III Chapin, F., Lambin, E., . . . van der Leeuw, S. (2009, December). *Planetary Boundaries: Exploring the Safe Operating Space for Humanity.* Retrieved from Jstor: https://www.jstor.org/stable/26268316

Sciencing. (2018, March). *Four Types of Biodiversity*. Retrieved from Sciencing: https://sciencing.com/four-types-biodiversity-8714.html

Shantikumar, S. (2018). *Methods of sampling from a population.* Retrieved from Health Knowledge: https://www.healthknowledge.org.uk/public-health-textbook/research-methods/1a-epidemiology/methods-of-sampling-population

Shorter, R., Raworth, K., Fanning, A., Sanz, C., & Bianco, K. (2020, September). *Dimensions of the Doughnut.* Retrieved from Doughnut Economics Action Lab: https://doughnuteconomics.org/tools-and-stories/30

Statistics How To. (2016, July 18). *What is Central Tendency Bias?* Retrieved from Statistics How To: https://www.statisticshowto.com/central-tendency-bias/

Stichting Klimaatvriendelijk Aanbesteden & Ondernemen. (n.d.). *Wat is de ladder*. Retrieved April 2021, from Stichting Klimaatvriendelijk Aanbesteden & Ondernemen: https://www.skao.nl/nl/wat-is-de-ladder

Test Centrum Groei. (n.d.). *Sectoren*. Retrieved 2021, from Test Centrum Groei: https://www.testcentrumgroei.nl/beroepen/sectoren

The Guardian. (2021, January). *Biden returns US to Paris climate accord hours after becoming president.* Retrieved from The Guardian: https://www.theguardian.com/environment/2021/jan/20/paris-climate-accord-joe-biden-returns-us

The New York Times. (2019). *Trump Serves Notice to Quit Paris Climate Agreement.* Retrieved from The New York Times: https://www.nytimes.com/2019/11/04/climate/trump-paris-agreement-climate.html

The Smithsonian. (n.d.). *Extinction Over Time*. Retrieved from The Smithsonian: https://naturalhistory.si.edu/education/teaching-resources/paleontology/extinction-over-time

Thomas, G. (2013). *How to do your research project.* London: SAGE Publications Ltd.

Time. (2021). *Time2030.* Retrieved from Time: https://time.com/time2030/

Trouw. (2020, November). *Alleen de stikstofuitstoot verminderen? 'Nee, stikstof én fosfor moeten tegelijkertijd omlaag'*. Retrieved from Trouw: https://www.trouw.nl/duurzaamheid-natuur/alleen-de-stikstofuitstoot-verminderen-nee-stikstof-en-fosfor-moeten-tegelijkertijd-omlaag~b8c14bf8/?referrer=https%3A%2F%2Fwww.google.com%2F

Union of Concerned Scientists. (2008, Juli 16). *Is There a Connection Between the Ozone Hole and Global Warming?* Retrieved from Union of Concerned Scientists: https://www.ucsusa.org/resources/ozone-hole-and-global-warming

United Nations. (2015). *The 17 Goals*. Retrieved from sdg's: https://sdgs.un.org/goals

United Nations. (2015, December). *The Paris Agreement.* Retrieved from United Nations Framework Convention on Climate Change: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

United Nations. (2017). *Maternal mortality rate.* Retrieved from Sustainable Development Report: https://dashboards.sdgindex.org/explorer/sdg3_matmort

United Nations. (2020). *Corruption Perception Index.* Retrieved from Sustainable Development Goals: https://dashboards.sdgindex.org/explorer/sdg16_cpi

United Nations. (2020). *Sustainable Development Report 2020*. Retrieved from Sustainable Developement Report: https://s3.amazonaws.com/sustainabledevelopment.report/2020/2020_sustainable_development_report.pdf

United Nations Development Programme. (n.d.). *Sustainable Development Goals*. Retrieved April 2021, from United Nations Development Programme: https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

United Nations Environment Programme. (n.d.). *About Montreal Protocol*. Retrieved from United Nations Environment Programme: https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol

Verhoeven, N. (2019). *Doing Research.* Boom uitgevers Amsterdam.

Voedingscentrum. (n.d.). *Wet- en regelgeving voedsel*. Retrieved February 2021, from Voedingscentrum: https://www.voedingscentrum.nl/encyclopedie/wet-en-regelgeving.aspx

Weber, R., & Wand, Y. (1990). *TOWARD A THEORY OF THE DEEP STRUCTURE OF INFORMATION SYSTEMS.* Retrieved from Citeseerx: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.477.3024&rep=rep1&type=pdf

Appendix

Appendix I – Global Overview of Ecological Sustainability

The planet is changing, this has become apparent and is dangerous for its inhabitants. Glaciers are melting due to climate change and coral reaves are shrinking and disappearing due to ocean acidification and changing heat conditions. (Flannery, 2015)

On top of this monsoon systems are being disrupted by air pollution and freshwater withdrawals, Phosphorus buildup is leading up to a major oceanic anoxic event, land is being deforested at an unprecedented rate, leading to carbon storage and overall resilience. (Rockström, et al., 2009)

Luckily there is also a little good news on this front, the Ozone layer, which had been depleted is starting to recover after the 1987 Montreal Protocol banned all chlorofluorocarbons and Halons gasses which up to that point were prevalent in aerosol sprays and as coolant in refrigerators (Nunez, 2019). Later it was found out that bromine and hydrochlorofluorocarbons also added to ozone depletion and these are also being phased out. (NASA, 2004) A prediction that the ozone layer would heal completely in the Northern Hemisphere by the 2030s, followed by the Southern Hemisphere in the 2050s and polar regions by 2060 has been made. (Nunez, 2019)

This is all happening through long-lasting processes that need constant monitoring and attention. The evidence against ignoring or curtailing the problem is vast, as it is now scientifically suggested that at least some past species of humanity (H. erectus, H. heidelbergensis, and H. neanderthalensis) are extinct mainly because of climate change. (Raia, et al., 2020)

That same fate could befall the current species of humanity (H. Sapiens Sapiens) if it does not manage the ecological impact of its actions on the planet (respect the ceiling). (Time, 2021) The current state of affairs pertaining to this ceiling can be found in the figure below.

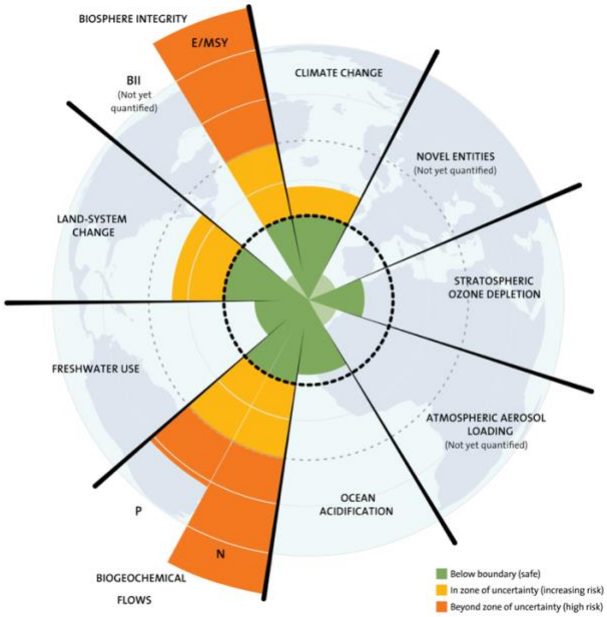


Figure 41 Planetary boundaries and how humanity is doing (Lokrantz & Azote, n.d.) based on (Rockström, et al., 2009)

In recent years more legislation has and (international) agreements have been introduced to manage the ecological impact worldwide, before these forms of legislation and agreements it was difficult to align economic interest with ecological sustainability. The best known and possibly most impactful of these agreements is the Paris Agreement, a legally binding international treaty on climate change signed by a 196 countries in 2015. This agreement sets the goal of limiting global warming to below 2 and preferably to around 1.5 degrees Celsius, compared to pre-industrial levels. (United Nations, 2015)

However, support for this agreement internationally seems shaky at best; In 2017, then President of the United States of America, Donald Trump, announced the country will withdraw from the Paris agreement (The New York Times, 2019) and on the 4th of November 2020 the country does just that. On top of this, there is little to no legal accountability for ignoring the objectives of the Paris agreement.

But there is also good news: On January 20th, 2021, President Joe Biden rejoins the Paris agreement hours after being installed as the new President of the United States of America. (The Guardian, 2021)

In the European Union a new plan to change the growth strategy of the union, called The European Green New Deal, has been making headway. The goal of the plan is to make the EU's economy sustainable by realizing:

- Net zero emission of greenhouse gasses by 2050
- Decoupling of economic growth from resource usage
- No person or place being left behind
- At least €1 trillion in (public) investments

(European Commission, 2020)

The previous paragraph describes the long-term (2050) goal, but the EU also has a short-term goal stretching from 2020 to 2030 in which time the goal is to cut CO_2 emissions by 55% compared to emission levels from 1990. (BBC, 2020)

With primary energy consumption still growing (1.3% in 2019) albeit more slowly than the year(s) before (2.8% in 2018), the world has increased its energy consumption for 10 consecutive years. And 84% of that energy consumption was delivered by fossil fuels, devastating the planet. However, with new goals and a strong fresh wind blowing through the landscape, renewable energy has grown impressively to around 10.4% of total energy consumption. (BP, 2019)

With new incentives, agreements, willingness and the eyes of the world fixed on ecological sustainability there seems to at least be hope for the future, but history has taught us to be skeptical. In the end, only time will tell.

Appendix II – Global Overview of Social Sustainability

While the planet is changing, and humanity is struggling to find a way to achieve getting below the ecological ceiling another important aspect of sustainability is also making headway: the social aspect of sustainability.

In India, with its population of 1.3 billion people, 189.2 million people are undernourished (Food and Agriculture Organization of the United Nations, 2020), in South Soudan the perceived level of public sector corruption is running rampant (United Nations, 2020) and in the Central African Republic 829 children died per 100.000 births (data from 2017) which is one of the highest maternal mortality rates in the world. (United Nations, 2017)

But beyond these, political voice, gender equality, health(care) and pretty much all social indicators are severely sub-par when looking at a global level.

An important step towards improvement is the 2030 agenda for sustainable development, which was adopted by all United Nations members in 2015. All of these United Nations members (nations) agreed to set a goal at bettering their nation's standing on 17 goals, called the Sustainable Development Goals (SDG's), most of these goals are a reflection of social sustainability (and some of ecological sustainability). (United Nations, 2015)

There has been close monitoring of this agenda ever since the United Nations members agreed upon its adoption, yet the governments are moving ever so slowly. What is noteworthy here is that there are countries which are doing extremely well and are showing vast increases in their social sustainability since 2015 but there are also countries who show vast decreases in their social sustainability since 2015. Overall, however, the world is doing slightly better, showing a 1.3% growth in overall sustainability since 2015.

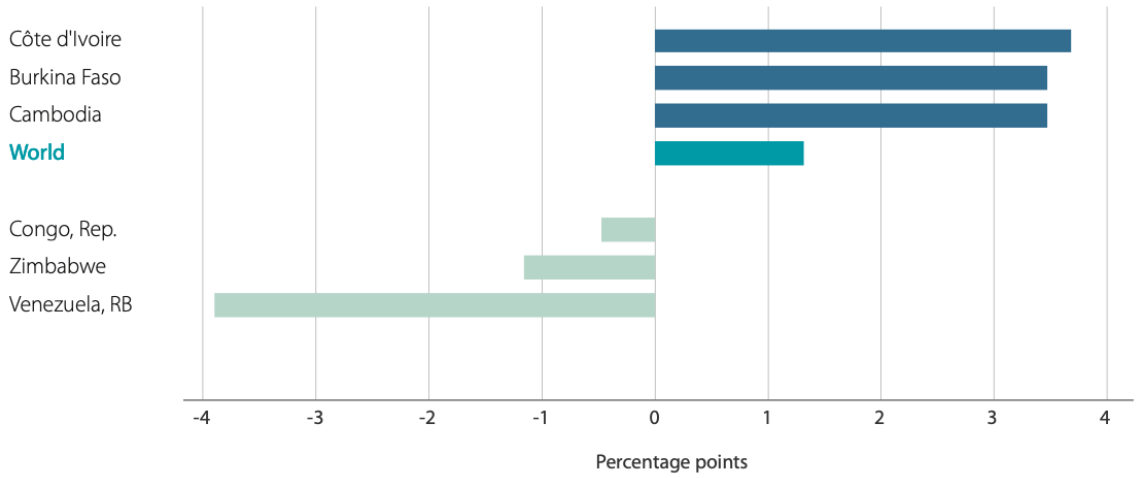


Figure 42 Countries whose SDG Index score has improved or decreased the most since 2015 (United Nations, 2020)

Another important aspect of note here is that low-income countries generally have lower SDG Index scores because the majority of the SDG's focus on ending extreme poverty and access to basic services and infrastructure while also lacking good infrastructure and mechanisms to manage key-crucial challenges of the SDG's. (United Nations, 2020)

Another important step is the Doughnut Economics model which combines social sustainability (foundation) with ecological sustainability (ceiling) and adopts clear indicators for both, showing the world it is not where it needs to be on both counts. (Raworth, Doughnut Economics - Seven ways to think like a 21st-Century Economist, 2017)

With a strong focus on social sustainability the SDG's definitely help the world along towards a more socially sustainable future. However, things are moving slowly, new models attracting attention and continuous reporting helps this along but is not a guaranty for success. Hope is strong, but once more, only time will tell what reality brings.

Appendix III – Interview Protocol & Questions

Questions: Ecological Sustainability

Interviewer: Wietze Kleisterlee
Interviewee: #1
Date and Time: 15-03-2021 16:00 t/m 17:00
Location: Zoom Conversation (password encrypted)

Intro

1. Can I record this conversation as to be able to reproduce it properly in text?
2. What is the name of the organization and department you operate in?
3. What function/role do you fulfill within your organization?
4. What education did you enjoy?
5. What element that pertains to my concept-thesis are you an expert in?
6. Why do you consider yourself an expert in this field?

Substantive – Overview -> Keeping in mind the scope of the research

7. What went right in this thesis in general/as a whole?
8. Does anything need improvement or is anything missing in this thesis in general/as a whole? *
9. What went right in the Model Design "Ecological Ceiling" sub-chapter in general / as a whole? *
10. Does anything need improvement or is anything missing in the Model Design "Ecological Ceiling" sub-chapter in general/as a whole? *

* In general / as a whole meaning: In its entirety, not about individual little things, but about overarching large subjects, cohesion, completeness and consistency.

Substantive – Model -> Keeping in mind the scope of the research

11. What went right in the Ecological Ceiling "*Climate Change*" sub-chapter?
12. Does anything need improvement or is anything missing in the Ecological Ceiling "*Climate Change*" sub-chapter?
13. What went right in the Ecological Ceiling "*Ocean Acidification*" sub-chapter?
14. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ocean Acidification*" sub-chapter?
15. What went right in the Ecological Ceiling "*Ozone Layer Depletion*" sub-chapter?
16. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ozone Layer Depletion*" sub-chapter?
17. What went right in the Ecological Ceiling "*Nitrogen & Phosphorus Loading*" sub-chapter?
18. Does anything need improvement or is anything missing in the Ecological Ceiling "*Nitrogen & Phosphorus Loading*" sub-chapter?
19. What went right in the Ecological Ceiling "*Freshwater Withdrawals*" sub-chapter?

20. Does anything need improvement or is anything missing in the Ecological Ceiling "*Freshwater Withdrawals"* sub-chapter?
21. What went right in the Ecological Ceiling "*Land Conversion*" sub-chapter?
22. Does anything need improvement or is anything missing in the Ecological Ceiling "*Land Conversion*" sub-chapter?
23. What went right in the Ecological Ceiling "*Biodiversity Loss*" sub-chapter as a whole?
24. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ecological Equity*" sub-chapter?
25. Last question: Can I use your name in my thesis? I will name you once in my methodology and possibly in the preface.

Questions: Social Sustainability (Doughnut Economics)

Interviewer: Wietze Kleisterlee
Interviewee: #2
Date and Time: 12-03-2021 14:00 t/m 15:00
Location: Zoom Conversation (password encrypted)

Intro

1. Can I record this conversation (as to be able to reproduce it properly in text and analyze the content properly)?
2. What is the name of the organization and department you operate in?
3. What function/role do you fulfill within your organization?
4. What education did you enjoy?
5. What element that pertains to my concept-thesis are you an expert in?
6. Why do you consider yourself an expert in this field?

Substantive – Overview -> Keeping in mind the scope of the research

7. What went right in this thesis in general/as a whole? *
8. Does anything need improvement or is anything missing in this thesis in general/as a whole? *
9. What went right in the model design "Social Foundation" sub-chapter in general / as a whole? *
10. Does anything need improvement in the model design "Social Foundation" sub-chapter in general/as a whole? *

* In general / as a whole meaning: In its entirety, not about individual little things, but about overarching large subjects, cohesion and consistency.

Substantive – Model -> Keeping in mind the scope of the research

11. What went right in the Social Foundation "*Food*" sub-chapter?
12. Does anything need improvement or is anything missing in the Social Foundation "*Food*" sub-chapter?
13. What went right in the Social Foundation "*Health*" sub-chapter?

14. Does anything need improvement or is anything missing in the Social Foundation "*Health*" sub-chapter?
15. What went right in the Social Foundation "*Education*" sub-chapter
16. Does anything need improvement or is anything missing in the Social Foundation "*Education*" sub-chapter?
17. What went right in the Social Foundation "*Income & Work*" sub-chapter?
18. Does anything need improvement or is anything missing in the Social Foundation "*Income & Work*" sub-chapter?
19. What went right in the Social Foundation "*Peace & Justice*" sub-chapter?
20. Does anything need improvement or is anything missing in the Social Foundation "*Peace & Justice*" sub-chapter?
21. What went right in the Social Foundation -> "*Political Voice*" sub-chapter?
22. Does anything need improvement or is anything missing in the Social Foundation "*Political Voice*" sub-chapter?
23. What went right in the Social Foundation "*Social Equity*" sub-chapter?
24. Does anything need improvement or is anything missing in the Social Foundation "*Social Equity*" sub-chapter?
25. What went right in the Social Foundation "*Gender Equality*" sub-chapter?
26. Does anything need improvement or is anything missing in the Social Foundation "*Gender Equality*" sub-chapter?
27. What went right in the Social Foundation "*Housing*" sub-chapter?
28. Does anything need improvement or is anything missing in the Social Foundation "*Housing*" sub-chapter?
29. What went right in the Social Foundation "*Networks*" sub-chapter?
30. Does anything need improvement or is anything missing in the Social Foundation "*Networks*" sub-chapter?
31. What went right in the Social Foundation "*Energy*" sub-chapter?
32. Does anything need improvement or is anything missing in the Social Foundation "*Energy*" sub-chapter?
33. What went right in the Social Foundation "*Water and Sanitation*" sub-chapter?
34. Does anything need improvement or is anything missing in the Social Foundation "*Water and Sanitation*" sub-chapter?
35. Last question: Can I use your name in my thesis? I will name you once in my methodology and possibly in the preface.

Questions: Ecological Sustainability

Interviewer: Wietze Kleisterlee
Interviewee: #3
Date and Time: 18-03-2021 13:00 t/m 14:00
Location: Zoom Conversation (password encrypted)

Intro

1. Can I record this conversation as to be able to reproduce it properly in text?
2. What is the name of the organization and department you operate in?
3. What function/role do you fulfill within your organization?
4. What education did you enjoy?
5. What element that pertains to my concept-thesis are you an expert in?
6. Why do you consider yourself an expert in this field?

Substantive – Overview -> Keeping in mind the scope of the research

7. What went right in this thesis in general/as a whole? *
8. Does anything need improvement or is anything missing in this thesis in general/as a whole? *
9. What went right in the Model Design "Ecological Ceiling" sub-chapter in general / as a whole? *
10. Does anything need improvement or is anything missing in the Model Design "Ecological Ceiling" sub-chapter in general/as a whole? *

* In general / as a whole meaning: In its entirety, not about individual little things, but about overarching large subjects, cohesion, completeness and consistency.

Substantive – Model -> Keeping in mind the scope of the research

11. What went right in the Ecological Ceiling "*Climate Change*" sub-chapter?
12. Does anything need improvement or is anything missing in the Ecological Ceiling "*Climate Change*" sub-chapter?
13. What went right in the Ecological Ceiling "*Ocean Acidification*" sub-chapter?
14. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ocean Acidification*" sub-chapter?
15. What went right in the Ecological Ceiling "*Ozone Layer Depletion*" sub-chapter?
16. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ozone Layer Depletion*" sub-chapter?
17. What went right in the Ecological Ceiling "*Nitrogen & Phosphorus Loading*" sub-chapter?
18. Does anything need improvement or is anything missing in the Ecological Ceiling "*Nitrogen & Phosphorus Loading*" sub-chapter?
19. What went right in the Ecological Ceiling "*Freshwater Withdrawals*" sub-chapter?
20. Does anything need improvement or is anything missing in the Ecological Ceiling "*Freshwater Withdrawals"* sub-chapter?
21. What went right in the Ecological Ceiling "*Land Conversion*" sub-chapter?

22. Does anything need improvement or is anything missing in the Ecological Ceiling "*Land Conversion*" sub-chapter?
23. What went right in the Ecological Ceiling "*Biodiversity Loss*" sub-chapter as a whole?
24. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ecological Equity*" sub-chapter?
25. Last question: Can I use your name in my thesis? I will name you once in my methodology and possibly in the preface.

Questions: Doughnut Economics – Design Traits & Ecological Sustainability

Interviewer: Wietze Kleisterlee
Interviewee: #4
Date and Time: 08-04-2021 – 11:00 t/m 12:00
Location: Zoom Conversation (password encrypted)

Intro

1. Can I record this conversation as to be able to reproduce it properly in text?
2. What is the name of the organization and department you operate in?
3. What function/role do you fulfill within your organization?
4. What education did you enjoy?
5. What element that pertains to my concept-thesis are you an expert in?
6. Why do you consider yourself an expert in this field?

Substantive – Overview -> Keeping in mind the scope of the research

7. What went right in this thesis in general/as a whole? *
8. Does anything need improvement or is anything missing in this thesis in general/as a whole? *

* In general / as a whole meaning: In its entirety, not about individual little things, but about overarching large subjects, cohesion, completeness and consistency.

Substantive – Model, Design Traits -> Keeping in mind the scope of the research

9. What went right in the Design Traits "*Purpose*" sub-chapter when looking at the translation of global to IT-organizational level?
10. Does anything need improvement or is anything missing in the Design Traits Ceiling "*Purpose*" sub-chapter when looking at the translation of global to IT-organizational level?
11. What went right in the Design Traits "*Governance*" sub-chapter when looking at the translation of global to IT-organizational level?
12. Does anything need improvement or is anything missing in the Design Traits Ceiling "*Governance*" sub-chapter when looking at the translation of global to IT-organizational level?
13. What went right in the Design Traits "*Networks*" sub-chapter when looking at the translation of global to IT-organizational level?

14. Does anything need improvement or is anything missing in the Design Traits Ceiling "*Networks*" sub-chapter when looking at the translation of global to IT-organizational level?
15. What went right in the Design Traits "*Ownership*" sub-chapter when looking at the translation of global to IT-organizational level?
16. Does anything need improvement or is anything missing in the Design Traits Ceiling "*Ownership*" sub-chapter when looking at the translation of global to IT-organizational level?
17. What went right in the Design Traits "*Finance*" sub-chapter when looking at the translation of global to IT-organizational level?
18. Does anything need improvement or is anything missing in the Design Traits Ceiling "*Finance*" sub-chapter when looking at the translation of global to IT-organizational level?

Substantive – Model, Ecological Sustainability -> Keeping in mind the scope of the research

19. What went right in the Ecological Ceiling "*Climate Change*" sub-chapter when looking at the translation of global to IT-organizational level?
20. Does anything need improvement or is anything missing in the Ecological Ceiling "*Climate Change*" sub-chapter when looking at the translation of global to IT-organizational level?
21. What went right in the Ecological Ceiling "*Ocean Acidification*" sub-chapter when looking at the translation of global to IT-organizational level?
22. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ocean Acidification*" sub-chapter when looking at the translation of global to IT-organizational level?
23. What went right in the Ecological Ceiling "*Ozone Layer Depletion*" sub-chapter when looking at the translation of global to IT-organizational level?
24. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ozone Layer Depletion*" sub-chapter when looking at the translation of global to IT-organizational level?
25. What went right in the Ecological Ceiling "*Nitrogen & Phosphorus Loading*" sub-chapter when looking at the translation of global to IT-organizational level?
26. Does anything need improvement or is anything missing in the Ecological Ceiling "*Nitrogen & Phosphorus Loading*" sub-chapter when looking at the translation of global to IT-organizational level?
27. What went right in the Ecological Ceiling "*Freshwater Withdrawals*" sub-chapter when looking at the translation of global to IT-organizational level?
28. Does anything need improvement or is anything missing in the Ecological Ceiling "*Freshwater Withdrawals"* sub-chapter when looking at the translation of global to IT-organizational level?
29. What went right in the Ecological Ceiling "*Land Conversion*" sub-chapter when looking at the translation of global to IT-organizational level?

30. Does anything need improvement or is anything missing in the Ecological Ceiling "*Land Conversion*" sub-chapter when looking at the translation of global to IT-organizational level?
31. What went right in the Ecological Ceiling "*Biodiversity Loss*" sub-chapter as a whole when looking at the translation of global to IT-organizational level?
32. Does anything need improvement or is anything missing in the Ecological Ceiling "*Ecological Equity*" sub-chapter when looking at the translation of global to IT-organizational level?
33. Last question: Can I use your name in my thesis? I will name you once in my methodology and possibly in the preface.

Questions: Doughnut Economics – Social Sustainability

Interviewer: Wietze Kleisterlee
Interviewee: #4
Date and Time: 08-04-2021 – 11:00 t/m 12:00
Location: Zoom Conversation (password encrypted)

Intro

1. Can I record this conversation as to be able to reproduce it properly in text?
2. What is the name of the organization and department you operate in?
3. What function/role do you fulfill within your organization?
4. What education did you enjoy?
5. What element that pertains to my concept-thesis are you an expert in?
6. Why do you consider yourself an expert in this field?

Substantive – Overview -> Keeping in mind the scope of the research

7. What went right in this thesis in general/as a whole? *
8. Does anything need improvement or is anything missing in this thesis in general/as a whole? *

* In general / as a whole meaning: In its entirety, not about individual little things, but about overarching large subjects, cohesion, completeness and consistency.

Substantive – Model, Social Sustainability -> Keeping in mind the scope of the research

9. What went right in the Social Foundation "*Food*" sub-chapter when looking at the translation of global to IT-organizational level?
10. Does anything need improvement or is anything missing in the Social Foundation "*Food*" sub-chapter when looking at the translation of global to IT-organizational level?
11. What went right in the Social Foundation "*Health*" sub-chapter when looking at the translation of global to IT-organizational level?
12. Does anything need improvement or is anything missing in the Social Foundation "*Health*" sub-chapter when looking at the translation of global to IT-organizational level?

13. What went right in the Social Foundation "*Education*" sub-chapter when looking at the translation of global to IT-organizational level?
14. Does anything need improvement or is anything missing in the Social Foundation "*Education*" sub-chapter when looking at the translation of global to IT-organizational level?
15. What went right in the Social Foundation "*Income & Work*" sub-chapter when looking at the translation of global to IT-organizational level?
16. Does anything need improvement or is anything missing in the Social Foundation "*Income & Work*" sub-chapter when looking at the translation of global to IT-organizational level?
17. What went right in the Social Foundation "*Peace & Justice*" sub-chapter when looking at the translation of global to IT-organizational level?
18. Does anything need improvement or is anything missing in the Social Foundation "*Peace & Justice*" sub-chapter when looking at the translation of global to IT-organizational level?
19. What went right in the Social Foundation -> "*Political Voice*" sub-chapter when looking at the translation of global to IT-organizational level?
20. Does anything need improvement or is anything missing in the Social Foundation "*Political Voice*" sub-chapter when looking at the translation of global to IT-organizational level?
21. What went right in the Social Foundation "*Social Equity*" sub-chapter when looking at the translation of global to IT-organizational level?
22. Does anything need improvement or is anything missing in the Social Foundation "*Social Equity*" sub-chapter when looking at the translation of global to IT-organizational level?
23. What went right in the Social Foundation "*Gender Equality*" sub-chapter when looking at the translation of global to IT-organizational level?
24. Does anything need improvement or is anything missing in the Social Foundation "*Gender Equality*" sub-chapter when looking at the translation of global to IT-organizational level?
25. What went right in the Social Foundation "*Housing*" sub-chapter when looking at the translation of global to IT-organizational level?
26. Does anything need improvement or is anything missing in the Social Foundation "*Housing*" sub-chapter when looking at the translation of global to IT-organizational level?
27. What went right in the Social Foundation "*Networks*" sub-chapter when looking at the translation of global to IT-organizational level?
28. Does anything need improvement or is anything missing in the Social Foundation "*Networks*" sub-chapter when looking at the translation of global to IT-organizational level?
29. What went right in the Social Foundation "*Energy*" sub-chapter when looking at the translation of global to IT-organizational level?
30. Does anything need improvement or is anything missing in the Social Foundation "*Energy*" sub-chapter when looking at the translation of global to IT-organizational level?

31. What went right in the Social Foundation "*Water and Sanitation*" sub-chapter when looking at the translation of global to IT-organizational level?
32. Does anything need improvement or is anything missing in the Social Foundation "*Water and Sanitation*" sub-chapter when looking at the translation of global to IT-organizational level?
33. Last question: Can I use your name in my thesis? I will name you once in my methodology and possibly in the preface.

Questions: Maturity Model

Interviewer: Wietze Kleisterlee
Interviewee: #5
Date and Time: 18-03-2021 15:30 t/m 16:30
Location: Zoom Conversation (password encrypted)

Intro

1. Can I record this conversation (as to be able to reproduce it properly in text and analyze the content properly)?
2. What is the name of the organization and department you operate in?
3. What function/role do you fulfill within your organization?
4. What education did you enjoy?
5. What element that pertains to my concept-thesis are you an expert in?
6. Why do you consider yourself an expert in this field?

Substantive – Overview -> Keeping in mind the scope of the research

7. What went right in this thesis in general/as a whole? *
8. Does anything need improvement or is anything missing in this thesis in general/as a whole? *
9. What do you think of the maturity model as a whole? *

* In general / as a whole meaning: In its entirety, not about individual little things, but about overarching large subjects, cohesion and consistency.

Substantive – Model -> Keeping in mind the scope of the research

10. What do you think of the choice of using the 5 responses of organizations as recorded in the Corporate To Do List (Literature Review) as the 5 categorizations/maturity levels? (think of, for example:)
    a. Fit
    b. Substantiation
11. What do you think of the choice of using the aspects of Doughnut Economics and the Design Traits as the elements which are measured? (think of, for example:)
    a. Fit
    b. Substantiation

12. What do you think of the way requirements are spread over different maturity levels? (think of, for example:)
    a. (Increased) Complexity
    b. Some levels are unobtainable (Health sub-chapter)
    c. Substantiation

The main objective of this research is to identify a ratio of adoption of sustainable IT (in The Netherlands), a maturity model gives a good overview of the status of different aspects of sustainability but doesn't give a single, definitive answer. The scoring model remedies this by categorizing an organization into a single maturity level (instead of just showing a spread over the different levels) and showing a border-value. Under this border-value, the organization is not considered sustainable and over this border-value the organization is considered sustainable.

13. Does the scoring model (Categorizing an Organization) make sense overall? (think of, for example:)
    a. Is it legible / understandable?
    b. Is it complete?
14. What do you think of the way worth in points (weights) are assigned to different maturity levels? (think of, for example:)
    a. Does it make sense?
    b. Substantiation?
15. What do you think of the categorization Ranges? (think of, for example:)
    a. Do they make sense?
    b. Complete?
    c. Substantiation?
    d. Range Distribution?
16. What do you think of the Concentration Correction of Aspects rule? (think of, for example:)
    a. Understandable?
    b. Complete?
    c. Fair/Unfair?
    d. Weighted properly?
    e. Reach its purpose? (i.e: punish those who don't have their sustainability organization in order)
17. Last question: Can I use your name in my thesis? I will name you once in my methodology and possibly in the preface.

Appendix IV – Interview Analyses

Questions: Ecological Sustainability (Doughnut Economics)
Interviewer: Wietze Kleisterlee
Interviewee: #1
Date and Time: 15-03-2021 16:00 t/m 17:00
Location: Zoom Conversation (password encrypted)

Coding:
- Education & experience
- Priority Aspects in Model?
- Distribution Key
- Chance of no one making top maturity level
- Result this thesis: No Distribution Key
- Make more practical
- Select a couple of the more important aspects
- Confirmation of Model
- Doubts about Nitrogen and Phosphorus limit lead to more research

Questions: Social Sustainability (Doughnut Economics)
Interviewer: Wietze Kleisterlee
Interviewee: #2
Date and Time: 12-03-2021 14:00 t/m 15:00
Location: Zoom Conversation (password encrypted)
Codeing:
- Experience & Education
- Good to operationalize from global to organizational model
- Choice IT or Organization
- Write Context in Introduction
- Work Law Obligation into model (Red planes)
- Add Profit (3 P's) to model
- Gym -> Add funding
- IT-relevance – Which aspects? Maybe focus on only a couple
- The more right you go, the more community (already in model)
- Policy from third column
- More to right in model = more policy and impact on organization
- Aspect Food -> Local Food
- Add funding for (gym) on health aspect
- Relation between aspects
- Create Oversight – What does a move to the right mean?

Questions: Ecological Sustainability
Interviewer: Wietze Kleisterlee
Interviewee: #3

Date and Time: 18-03-2021 13:00 t/m 14:00
Location: Zoom Conversation (password encrypted)

Coding:

- Experience & Education
- Small Business Innovation
- Low Amount of Sustainability Goals
- Low Amount of Oversight / Bad Structure
    - Leads to bad policy
- Link Social Aspects to SDG's

Questions: Doughnut Economics (entirety, overarching)
Interviewer: Wietze Kleisterlee
Interviewee: #4
Date and Time: 08-04-2021 – 11:00 t/m 12:00
Location: Zoom Conversation (password encrypted)
Coding:

- Good to operationalize from global to organizational model
- Context -> Why IT organization
- Become more practical
- More focus on Characteristics of IT-employees/management
- More power consumption, more CO2 footprint, more waste, needs to be solved
- Add circularity to model
- Add circularity ladder to model
- Material Selection and recycling in requirements
- Pick a couple of relevant aspects
- Outsourced IT or inhouse IT?
- Change Intro
- Create overview and add more management assessment on sustainability the more you go to the right
    - also include in governance
- Feels more like corporate model
    - Design Traits
    - Governance
    - Choice of Words
- Keep brand popularity, cutting costs and greenwashing apart
- Scoring rules -> addition of 2nd rule for "good policy"
- Ozone Layer Depletion, difficult terminology (compounds)

Questions: Maturity Model
Interviewer: Wietze Kleisterlee
Interviewee: #5
Date and Time: 18-03-2021 15:30 t/m 16:30
Location: Zoom Conversation (password encrypted)

Coding

- Experience & Education
- Positive feedback, on the right road
- Keep model as Generic as possible
- Maturity levels, clear, well defined
- Possibly add, CO2 Ladder
- Scoring is clear
- Model Scoring -> Needs balancing for “good policy”
- Model Scoring -> Agreed need on balancing for good policy
- Policy without structure at “Do what Pays now”
- More to the right = More Complexity
- Testrun

Appendix V - Survey

<English Below>

Hallo en welkom bij de enquete over duurzaamheid in IT-afdelingen.

Eerst een snelle uitleg van wat Doughnut Economics is en waar dit onderzoek over gaat
Doughnut Economics is een recent concept in de economische wetenschap, geschreven door Kate Raworth, dat op mondiaal niveau een model biedt om een verandering in de denkwijze over economische uitgangspunten tot stand te brengen. Een waarin wordt afgestapt van het meten van succes van een gemeenschap aan de hand van een financiële indicator (zoals bv: Het Bruto Binnenlands Product) en meer aan de hand van sociale en ecologische indicatoren die een nauwkeuriger beeld geven van hoe het gaat met een gemeenschap.

Van dit model is een doorvertaling van mondiaal naar IT-organisatie (departement) niveau gemaakt met als doel te meten hoe duurzaam IT-afdelingen van organisaties zijn volgens deze nieuw doorvertaalde criteria van Doughnut Economics.

Vervolgens wat praktische informatie
Deze enquete bestaat uit 28 vragen en helpt u inzicht te creëren in de duurzaamheid van uw IT-afdeling. De vragen zijn in het Engels geformuleerd en het duurt gemiddeld 15 minuten om hem in te vullen en is het comfortabelst in te vullen op een computer in plaats van een telefoon.

De meest gestelde vraag binnen dit onderzoek is binnen welke situatie u uw organisatie plaatst, er worden hierbij 5 situaties geschetst. Dit betekent niet dat uw organisatie 1 op 1 overeen zal komen of 100% aan moet sluiten bij die situatie, maar er is wel een situatie die uw organisatie het best omschrijft.

Als u klaar bent kunt u onderaan deze pagina (onder de Engelse vertaling van dit bericht) op de pijl naar rechts klikken om te beginnen met het beantwoorden van vragen.

<English>
Hello and welcome to the survey about sustainability in the IT-department.

First, a quick explanation of what Doughnut Economics is and what this research is about
Doughnut Economics is a novel concept in Economic Science, written by Kate Raworth, that offers a model at the global (worldwide) level to realize a change in the way of thinking about economic principles. A way of thinking in which the approach to analyzing the success of a community is not a financial indicator (like GDP) but social and ecological indicators that indicate how a community is doing more accurately.

This model has been translated/downscaled from a global (worldwide) level to IT-organizational (departmental) level, with the goal of analyzing the sustainability of IT-departments of

organizations according to the definition of this translation/downscaling of the aspects of Doughnut Economics.

Some practical information
This survey consists of 28 questions and helps you create insights into the sustainability of your IT-department. The questions are formulated in English and take 15 minutes to fill out. It is most comfortable and easiest to fill out this survey on a computer (as opposed to your phone).

The question that is most common in this survey is "What situation describes your organization's situation best". This does not mean your organization needs to completely match the described situation 100%, but there is a situation that will be closest to your organization's situation.

When you are done reading this message you can click on the arrow to the right at the bottom of the screen to start answering questions.

General Info

Q1. Which organization do you represent?
…

Q2. What function/role do you perform within that organization?
…

Q3. What industry (sector) does your organization operate in?
- Healthcare and Wellbeing
- Trade and Services
- Information and Communication Technology (ICT)
- Justice, Security and Public Administration
- Agriculture, Nature and Fishing
- Media and Communication
- Education, Culture and Science
- Engineering, Production and Construction
- Tourism, Recreation and Catering
- Transport and Logistics

Q4. What size is your organization?
- Micro (Organization with 9 or less active employees)
- Small (Organization with 10 up to and including 49 active employees)
- Medium (Organization with 50 up to and including 249 active employees)
- Substantial (Organization with 250 up to and including 999 active employees)
- Large (Organization with 1000 up to and including 4999 active employees)
- Very Large (Organization with 5000 or more active employees)

Design Traits

Q5. Which situation describes your organization best?

Purpose

Here, a difference is made between a *narrow* and a *living* purpose:

- A *narrow* purpose is one that aims at just financial success
  - Example: “We aim to be the biggest computer manufacturer”
- A *living* purpose is one that aims at adding something to the world and its inhabitant
  - Example: “We aim to bring sustainability to computer manufacturing”

A	B	C	D	E
Has a narrow, purely financial purpose	Has a narrow, mostly financial purpose paired with some (easy to achieve) social/ecological goals	Has a living purpose, but is still caught in degenerative* thi nking	Has a living purpose with a clear non-financial “bigger than just us” goal where the net total emissions equal zero.	Has a living purpose in which the organization wants to add (social/ecologic al) benefits to society by being generative and distributive

*Degenerative thinking means an organization is still thinking in terms of "how can we make things less bad" instead of "how can we add benefits".

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q6. Which situation describes your organization best?

Governance

Here, a difference is made between a *tight* and a *mission* focus

- A *tight* focus on governance is one that is bent on achieving short-term, financial success and is often controlled by capital markets
    - Example: Weekly reporting focus on turnover and profit
- A *mission* focus on governance is one that is focused on achieving long-term transformative action and is controlled by someone dedicated to a social mission

A	B	C	D	E
Has a tight, purely financial focus with metrics aimed at turnover and market share	Has a tight focus, with metrics aimed at turnover and market share and smaller sustainability initiatives that cut costs (be it directly or indirectly, avoiding fines/boosting sales etc)	Has a mission focus with a mix of metrics aimed to achieve (some) minimal sustainability goals (set by governments) and short-term financial gain	Has a mission focus with metrics for long-term action that enable zero-emissions, no degradation of the social foundation and is delegated to those on a social mission	Has a mission focus, with no/less (or less emphasis on) metrics aimed at short-term financial gain but long-term transformative, generative and distributive action and is controlled by those on a social mission

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q7. Which situation describes your organization best?

Networks

A	B	C	D	E
Network of customers, suppliers and partners that is purely there for short-term financial gain and the organization has no interest in changing this	Network of customers, suppliers and partners that is there for short-term financial gain but also includes a small number (relative to the total amount) of sustainable organizations, organization has no interest in changing this.	Network of customers, suppliers and partners that is diverse and know the values and purpose of the organization, organization is actively involved in keeping network diverse (slight sustainability purpose/value integration)	Network of customers, suppliers and partners that knows of and agrees with the values and purpose of the organization and is aimed towards a zero emission and zero social foundation degradation future (partial sustainability purpose/value integration)	Network of customers, suppliers and partners that knows of and agrees with the values and purpose of the organization and is aimed and actively contributes towards a generative future (total sustainability purpose/value integration)

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q8. Which situation describes your organization best?

Ownership

Here, we distinguish between *absentee* and *rooted* ownership:

- *Absentee* ownership is ownership that is disconnected from the life of the organization
  - Example: Owned by the Stock Market (more share-traders, not shareholders)
- *Rooted* ownership is ownership that is in human hands
  - Example: Owned by its employees, a founding family, values-based investors or in public organizations: stakeholders like citizens

A	B	C	D	E
Organization has absentee ownership which feels it has no line it won't cross for the bottom line	Organization has absentee ownership which decides to do "some of the right things, for the wrong reasons", short-term financial gain	Organization can have absentee or rooted ownership that is willing to match national goals	Organization has rooted ownership that commits to net zero emissions	Organization has rooted ownership that commits to being generative (looking for ways to not just "be less bad" but actually be good) and distributive

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q9. Which situation describes your organization best?

Finance

Here, a distinction between *share traders* and *shareholders* is made:

- A *share trader is* focused on quick and high returns
- A *shareholder** has a commitment to ecological and social progress (with a fair, but ultimately smaller financial return)

A	B	C	D	E
Organization is financed by share traders wanting only fast financial returns and don't care how they come by those (willing to incur fines if that leads to financial gains)	Organization is financed by share traders wanting fast financial returns but are willing to invest in sustainability if that increases their personal gain	Organization can be financed by both share traders and shareholders who commit to minimal goals set by regulation	Organization is financed by value driven shareholders who have a shared value towards ecological and social mission zero (no net emissions, no social foundation deterioration)	Organization is financed by value driven shareholders who have a shared value towards ecological and social generative (more than just "being less/not bad" but wanting to add to the world) sustainability

*In the public sector a shareholder can be seen as where the public organization finds its financing, in nearly all cases this would be citizens

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Social Foundations

Q10. Which situation describes your organization best?

Food

A	B	C	D	E
The organization does not provide safe, nutritious, affordable food, a place to consume it or does not locate itself near a place where it can be purchased against a reasonable price	The organization locates itself near a source where safe, nutritious, food can be purchased but does not concern itself with affordability. Or motivation for providing safe, nutritious, affordable food is purely organizational gain (like attracting talent or lowering absenteeism).	The organization provides safe, nutritious, affordable food or locates itself near a source where safe, nutritious, affordable food can be purchased against a reasonable price and provides a pleasant place to consume it to commit to national targets	The organization has its own food policy that is aimed at: 1. Providing all its employees with safe, nutritious, affordable food 2. Sourcing food locally as much as possible 3. A pleasant place to consume it 4. Come to net zero emissions in the entire food chain 5. Periodically analyze the situation to look for improvements	The organization has its own food policy that is aimed at: 1. Providing its employees and the (local) community with safe, nutritious, affordable food and 2. Sourcing food locally as much as possible 3. Waste disposal is circular (composting etc.) 4. A pleasant place to consume it 5. Take away harmful emissions and add in positive ways to the environment when looking at the entire food chain 6. (Periodically) analyze the situation to look for improvements 7. Growing food (through, for example; Urban Farming)

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q11. Which situation describes your organization best?

Health

In The Netherlands, there is a national, mandatory obligation for each individual to purchase healthcare insurance. Because of this, The Netherlands as a whole (including the organizations within it already) provides access to affordable, quality healthcare and thus meets the standard as far as health goes. As a consequence, the first (lowest) 2 levels of maturity ("A" and "B") are impossible to achieve.

A	B	C	D	E
		The organization 1. Follows the law 2. (Possibly) Has additional health measures in place for senior employees (such as: a gym, gym membership (compensation), counselors and/or collective healthcare insurance)	The organization has an 'additional health policy' that is aimed at: 1. Providing additional healthcare facilities / measures, such as: a. a gym b. gym membership (compensation) c. counselors and/or d. collective healthcare insurance) to all employees 2. Analyzing the impact of its actions (and what it asks of its own employees) on the health of its own employees and coming to net zero harm towards these employees. 3. Coming to net zero emissions in the entire health(care) chain	The organization has an 'additional health policy' that is aimed at: 1. Providing additional healthcare facilities / measures such as a. a gym b. gym membership (compensation) c. counselors and/or d. collective healthcare insurance) to all employees and the (local) community 2. Analyzing the impact of its actions (and what it asks of its own employees) on the health of its own employees and the (local) community and instead of "doing no harm" making their health better than it was as a result 3. Incentivizes unhealthy employees and (local) community members to make use of facilities/measures 4. Take away more harmful emissions than are expelled into the environment when

looking at the entire health(care) chain

- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q12. Which situation describes your organization best?

Education

A	B	C	D	E
The IT-organization does not provide any type of education	The IT-organization provides (partial funding for) education to employees when it needs (or anticipates the need for) new expertise	The IT-organization provides (funding for) education to employees who ask for it	The IT-organization has its own education policy aimed at: 1. Providing (funding for) education and educational infrastructure for all employees designed around their personal advancement wishes and timing 2. Analyzing the impact of its actions (and what it asks of its own employees) on the education of its own employees and coming to at least net zero education deterioration towards these employees 3. Coming to net zero emissions in the entire	The IT-organization has its own education policy aimed at: 1. Providing education and educational infrastructure for all employees designed around their personal advancement wishes and timing 2. Providing education and/or educational infrastructure for (local) community and network 3. Analyzing the impact of its actions (and what it asks of its own employees) on the education of its own employees and the (local) community and adding more education to both the employees as well as the (local) community. 4. Take away more harmful emissions than are expelled into the environment when

			education chain	looking at the entire education chain

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q13. Which situation describes your organization best?

Income & Work

In The Netherlands there is a national mandatory obligation to pay a minimum wage, because of this it is impossible for organizations to pay below that minimum wage, which is a living wage (meaning it provides enough financial room to live). As a consequence, the first (lowest) 2 levels of maturity ("A" and "B") are impossible to achieve in The Netherlands.

A	B	C	D	E
		The IT-organization pays a living, minimum wage that is applicable to all employees and allows the individual to	The IT-organization: 1. Pays at least a living, minimum wage that is applicable to all employees and allows the individual	The IT-organization: 1. Pays at least a living, minimum wage that is applicable to all employees and allows the individual to

	(financially) live their life.	to (financially / socially) live their life 2. Has a written structure (rules and regulations) to indicate growth in: a. Work status b. Work responsibility c. Wage increase 3. Analyses the impact of its actions on the income & work of its own employees and comes to at least net zero income and work deterioration towards these employees	(financially / socially) live their life 2. Deliberates with its employees, creating insight in their situation and needs and uses that information as a factor on which wage is based 3. Works with underprivileged people and gives these people a chance within the organization 4. Analyses the impact of its actions on income & work both locally and globally and actively contributes to an income and work improvement on both counts

- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q14. Which situation describes your organization best?

Peace & Justice

A	B	C	D	E
1. The IT-organization does not provide a safe working environment and/or good arbitration of disputes 2. Employees feel unsafe 3. Employees feel unfairly treated when	1. The IT-organization provides counsellors to mediate, the goal is to create organizational value (for example keep absenteeism in check) 2. Employees feel slightly safe	1. The IT-organization provides counsellors to mediate 2. The IT-organization provides a complaint procedure & complaints committee 3. The organization is GDPR compliant	1. The IT-organization provides counsellors to mediate 2. The IT-organization provides a complaint procedure & complaints committee 3. The organization is GDPR compliant 4. The IT-organization analyses the impact of its actions on the Peace and Justice of its own employees	1. The IT-organization provides counsellors to mediate 2. The IT-organization provides a complaint procedure & complaints committee 3. The organization is GDPR compliant

it comes to disputes	3. Employees feel they are only treated fairly sometimes when it comes to disputes	4. Employees feel safe 5. Employees feel they are treated fairly in general when it comes to disputes	and coming to at least net zero Peace and Justice deterioration towards these employees 5. The IT-organization comes to net zero emissions in the entire peace and justice chain 6. Employees feel very safe 7. Employees feel they are treated fairly when it comes to disputes	4. The IT-organization analyses the impact of its actions (and what it asks of its own employees) on the peace and justice of its own employees and inhabitants of the world and comes to a net positive peace and justice improvement 5. Employees feel very safe 6. Employees feel they are treated fairly when it comes to disputes

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q15. Which situation describes your organization best?

Political Voice

A	B	C	D	E
1. The organization does not provide any type of method to collect feedback and enable co-	1. The organization provides a suggestion box to collect feedback, feedback that leads to possible financial profit is taken into	1. The organization provides a councilor to collect feedback and suggest improvements to the board 2. Employees feel they have a voice in	1. The organization provides the opportunity, framework and funding for a works council (composed of employees) that represents	1. The organization provides the opportunity, framework and funding for a works council (composed of employees) that represents the employees 2. Employees feel they have a strong voice in

	determination	consideration	organizational policy and practices	the employees	organizational policy
2.	employees feel they have no voice in organizational policy and practices	2. Employees feel they have a very limited voice in organizational policy and practices		2. Employees feel they have a strong voice in organizational policy and practices 3. The works council & organization aim at net zero emissions	3. The organization provides or takes part in a (local) community council to generate (local) value and generate community feedback 4. The works council & organization aim at taking away more harmful emissions than are expelled into the environment

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q16. Which situation describes your organization best?

Social Equity

A	B	C	D	E
1. The organization does not ensure equality of opportunity and/or reduce income inequality amongst employees 2. Employees feel they or some of	1. The organization ensures equal opportunity through equal rights and liberties where it pays to do so but does not (or reluctantly) reduce	The organization ensures equal opportunity and reduces income inequality through: 1. matching national targets and ensuring equal rights	The organization has its own Social Equity policy aimed at ensuring equal opportunity and income equality through: 1. Internal Diversification 2. Equal rights and liberties for all, especially focused on… a. Race b. ethnicity c. sexual orientation	The organization has its own Social Equity policy aimed at ensuring equal opportunity and income equality through: 1. Internal Diversification 2. Equal rights and liberties for all, especially focused on… a. Race b. ethnicity

those around them are not treated as equals 3. Employees feel they or some of those around them are not financially compensated as equals	income inequality 2. Employees feel they and/or those around them are mostly treated as equals 3. Employees feel they or some of those around them are not financially compensated as equals	and liberties 2. Employees feel they and those around them are treated as equals 3. Employees feel they and those around them are fairly financially compensated as equals	d. religion e. age f. language g. disability h. location 3. Informing and educating 4. Analyzing the impact of its actions on equal opportunity and the income equality of its own employees and coming to net zero social equity deterioration towards these employees 5. Finding interest groups and actively consulting them 6. Employees feel they and those around them are treated as equals 7. Employees and those around them are fairly financially compensated as equals	c. sexual orientation d. religion e. age f. language g. disability h. location 3. Informing and educating 4. Analyzing the impact of its actions on equal opportunity and income equality and generating extra benefits for its employees and (local) community 5. Finding interest groups and actively consult and contribute to these 6. Employees feel they and those around them are treated as equals 7. Employees and those around them are fairly financially compensated as equals

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q17. Which situation describes your organization best?

Gender Equality

A **B** **C** **D** **E**

The organization does not provide any (moral) rules, guidelines or policy to further the cause of gender equality	The organization provides some (moral) rules or guidelines to further the cause of gender equality but only non-binding (no penalties or consequences) and only as far as they are incentivized by financial gain or law	The organization provides some clear (moral) rules or guidelines that are binding (meaning there are consequences and/or penalties) to further the cause of gender equality	The organization has clear policy that: 1. Focusses on ensuring all genders (employees) equal access to: a. Education b. Health care c. An enjoyable job d. Internal representation 2. Finds and consults interest groups on the subject of gender equality 3. Analyzes the impact of its actions on the gender equality of its own employees and comes to net zero gender equality deterioration towards these employees	The organization has clear policy that: 1. focusses on ensuring all genders equal access to: a. Education b. Health care c. An enjoyable job d. Internal representation 2. Enforces gender equality by (voluntarily) setting gender equality quota's 3. Finds interest groups and actively consults and contributes to them on the subject of gender equality 4. Analyzes the impact of its actions on the gender equality of its employees and the (local) community and comes to net positive gender equality contribution

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q18. Which situation describes your organization best?

Housing

A	B	C	D	E
The IT-organization does not provide a well ventilated, heated in winter and cooled in summer, sound-safe, hygienic and pleasant workplace / office housing	The IT-organization provides very basic (below adequate): 1. Ventilation 2. Heat in winter 3. Cool in summer 4. Sound safety and… 5. Hygienic 6. A pleasant workplace / office housing for short-term financial gain	The IT-organization provides decent (adequate): 1. Ventilation 2. Heat in winter 3. Cool in summer 4. Sound safety and… 5. Hygienic 6. A pleasant workplace / office housing	1. The IT-organization has clear policy that focusses on ensuring all employees have: a. Adequate ventilation b. Heat in winter c. Cool in summer d. Sound safety e. Hygienic f. A pleasant workplace / office housing 2. The IT-organization analyzes the impact of its actions on the housing of its own employees and comes to net zero housing deterioration towards these employees 3. The IT-organization mediates for affordable, sustainable (net zero emissions) housing for employees	1. The IT-organization has clear policy that focusses on ensuring all employees have: a. Adequate ventilation b. Heat in winter c. Cool in summer d. Sound safety e. Hygienic f. A pleasant workplace / office housing 2. The IT-organization Analyzes the impact of its actions on the housing of its own employees and comes to a net positive housing contribution towards these employees 3. The IT-organization mediates for or creates affordable, sustainable housing for living in (that generates more resources than it uses) for its employees

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q19. Which situation describes your organization best?

Networks

A	B	C	D	E
The IT-organization does not provide any: 1. (Funding for) (public) transport from and to work 2. (Funding for) Ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. Employees feel they are out of touch with colleagues 5. Employees use and/or pay for their own (public) transport	The IT-organization provides: 1. Partial funding for ways of remote communication to come to a better financial result, like A. Phone B. Phone plan C. Computer D. Internet The organization does not provide: 2. (Funding for) (public) transport from and to work 3. (Funding for) Councilors 4. Employees feel in touch with their colleagues 5. Employees use and/or pay for their own (public) transport	The IT-organization provides: 1. (funding for)(public) transport from and to work 2. (funding for) Ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. Employees feel in touch with their colleagues 5. Employees use (public) transport funded or loaned (to them) by the organization	The IT-organization provides and has a clear policy on: 1. (funding for) (public) transport from and towork 2. (funding for) ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (Funding for) Councilors 4. Analyzing the impact of its actions on the networks of its own employees and comes to net zero network deterioration towards these employees 5. Coming to net zero emissions in the entire network 6. Employees feel in touch with their colleagues 7. Employees use (public) transport funded or loaned (to them) by the organization	The IT-organization provides and has a clear policy on: 1. (funding for) (public) transport for the (local) community & employees 2. (funding for) ways of remote communication like A. Phone B. Phone plan C. Computer D. Internet 3. (funding for) Councilors 4. (Funding for) A (local) outreach program 5. Analyzing the impact of its actions on the networks of its own employees and (local) community and actively contributes (knowledge, labor, funding, infrastructure) to them 6. Employees feel in touch with their colleagues and the (local) community 7. Employees use (public) transport funded or loaned (to them) by the organization

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best

- Situation E describes my organization best

Q20. Which situation describes your organization best?

Energy

A	B	C	D	E
The IT-organization does not make available any energy freely or generate any clean energy itself	The IT-organization makes energy available where it aids the financial gain of the organization and/or generates a little (but not enough by a long shot) (clean) energy which it uses and/or sells to the highest bidder for financial gain	The IT-organization makes energy available to all employees and/or generates clean energy (through wind, solar, heat and/or hydro) which it uses to limit its own footprint	1. The IT-organization makes (largely green) energy available to all employees 2. The IT-organization generates enough clean energy (through wind, solar, heat and/or hydro) to be energy neutral 3. The IT-organization shares its knowledge around getting to energy neutral terrain	1. The IT-organization makes green energy available to employees and (local) community 2. The IT-organization generates clean energy (through wind, solar, heat and/or hydro), generating more clean energy than it uses for operations a. This energy is shared (possibly against beneficial rates) with the (local) community 3. The IT-organization shares its knowledge around energy generation with the (local) community 4. Analyzes the impact of its actions on the energy of its own infrastructure and (local) community and comes to a net positive contribution towards the infrastructure and the (local) community

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q21. Which situation describes your organization best?

Water and Sanitation

A	B	C	D	E
The organization does not provide or generate any clean water or toilets and soap	The organization purchases and provides clean water, toilets and soap to its employees to keep them working (financial gain is motivation)	The organization provides clean water, toilets and soap to its employees and either: 1. Generates a (small) portion of their water use themselves 2. Compensates the use of water by a financial construction	The organization provides clean water, toilets and soap to their employees and: 1. Generates enough water to compensate their use or… 2. Compensates the use of water by a financial or replenishing construction and… 3. Analyses the impact of its actions on the water and sanitation of its own employees and comes to net zero water and sanitation deterioration towards these employees 4. Comes towards net zero emissions	The organization provides clean water, toilets and soap and either: 1. Generates enough water to add to the (local) community 2. Analyzes the impact of its actions on the water and sanitation of its own employees and (local) community and comes to a net positive contribution towards these employees and the (local) community

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Ecological Ceiling

Q22. Which situation describes your organization best?

Climate Change and Ocean Acidification

A	B	C	D	E
The IT-organization does not think of, measure (from design/pre-purchase to execution/purchase to end of life), compensate or limit its CO_2 emissions	The IT-organization: 1. measures its CO_2 emissions and… 2. Slightly cuts CO_2 emissions (smaller initiatives when looking at the whole of the IT-organization) to avoid fines and/or boost income (inherent motivation is more profit)	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Limits its CO_2 emissions to 0.272 tons per employee per year (meeting the Paris Agreement goal of staying under 2 degrees centigrade global warming)	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and subtractions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Comes to net zero CO_2 emissions by (examples): a. *Design* i. Green (building) design and strategy ii. Material selection analysis iii. Using CO_2 emissions as an important factor in (purchase) decisions b. *Renewables, waste and reduction* i. Purchasing green electricity ii. Drastically reducing fossil fuel use and investment	The IT-organization has a clear policy that: 1. measures its CO_2 emissions and subtractions and is able to break this down per subset of the IT-organization 2. Sets CO_2 goals per subset of the IT-organization 3. Takes more CO_2 out of the air than it puts in by (examples): a. *Design* i. Green (building) design and strategy ii. Material selection analysis iii. Using CO_2 emissions as an important factor in (purchase) decisions b. *Renewables, waste and reduction* i. Purchasing green electricity ii. No more fossil fuel use or investment

iii. Sustainable mobility plans
iv. Waste audits
v. (Financing the) Planting (of) forests
vi. Drawdown Technology and sequestration
vii. Offering more plant-based food than meat

c. Finding and consulting interest groups on the subject of net zero CO_2 emissions

4. Encourages its network to do the same

iii. Sustainable mobility plans
iv. Waste audits
v. (Financing the) Planting (of) forests
vi. Drawdown Technology and sequestration
vii. Offering more plant-based food than meat

c. Finding, consulting and actively contributing to interest groups on the subject of generative CO_2 solutions

4. Encourages its network to do the same

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q23. Which situation describes your organization best?

Ozone Layer Depletion

A	B	C	D	E
The IT-organization does not think of, measure (from design/pre-purchase to execution/purchase to end of life), compensate or limit its chlorofluorocarbon, hydrochlorofluorocarbon and halons gasemissions nor does it limit bromine compounds	The IT-organization slightly limits its use of chlorofluorocarbon, hydrochlorofluorocarbon and/or halons gas emissions and bromine compounds to achieve a better short-term financial result (inherent motivation is more profit short-term)	The IT-organization has a clear policy that: 1. Measures its chlorofluorocarbon, hydrochlorofluorocarbon halons gas and bromine compound emissions 2. Completely stops any chlorofluorocarbon and halons gas emissions 3. Severely limits the use and emission of hydrochlorofluorocarbon and bromine compounds	The IT-organization has a clear policy that: 1. Measures its chlorofluorocarbon, hydrochlorofluorocarbon halons gas and bromine compound emissions 2. Completely stops any chlorofluorocarbon, hydrochlorofluorocarbon, halons gas and bromine compound use and emissions 3. Finds and consults interest groups on the subject of net zero ozone layer depleting emissions 4. Encourages Network to do the same	The IT-organization has a clear policy that: 1. Measures its chlorofluorocarbon, hydrochlorofluorocarbon halons gas and bromine compound emissions 2. Completely stops any chlorofluorocarbon, hydrochlorofluorocarbon, halons gas and bromine compound use and emissions 3. Finds, consults and actively contributes to interest groups on the subject of being generative on ozone layer depletion 4. Encourages Network to do the same

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q24. Which situation describes your organization best?

Nitrogen & Phosphorus Loading

A	B	C	D	E
The organization does not think of, measure, compensate or limit its nitrogen and/or phosphorus emissions	The organization slightly limits its use of nitrogen and/or phosphorus emissions where this leads to a better short-term financial result (inherent motivation is more profit short-term)	The organization has a clear policy that: 1. Measures its Phosphorus and Nitrogen emissions 2. Limits its Phosphorus emissions to 0.782kg per year per employee by 2030 3. Limits its Nitrogen emissions to 2.465kg per year per employee by 2030 In order to match the Dutch National Goal	The organization has a clear policy that: 1. Measures its Phosphorus and Nitrogen emissions (per subset of the IT-organization) 2. Limits its Phosphorus emissions to 0.153kg per year per employee 3. Limits its Nitrogen emissions to 1.513kg per year per employee 4. Finds and consults interest groups on the subject of being net zero on Nitrogen & Phosphorus Loading 5. Encourages Network to do the same	The organization has a clear policy that: 1. Measures its Phosphorus and Nitrogen emissions (per subset of the IT-organization) 2. Limits its Phosphorus emissions to *lower*than 0.153kg per year per employee 3. Limits its Nitrogen emissions to *lower*than 1.513kg per year per employee 4. Sequesters Phosphorus & Nitrogen 5. Finding, consulting and actively contributing to interest groups on the subject of being generative on Nitrogen & Phosphorus Loading 6. Encourages network to do the same

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q25. Which situation describes your organization best?

Freshwater Withdrawals

A	B	C	D	E
The IT-organization does not think of, measure, compensate or limit its freshwater withdrawals	The IT-organization limits the use of freshwater withdrawals where this leads to a better short-term financial result (inherent motivation is more short-term profit) and is otherwise uninvolved	The IT-organization has a clear policy that: 1. Measures its Freshwater withdrawal 2. Limits its freshwater withdrawal to 97.58 m^3 per employee, per year	The IT-organization has a clear policy that: 1. Measures its freshwater withdrawal per subset of the IT-organization 2. Comes to net zero freshwater withdrawal (often closed loop systems and compensation) 3. Encourages finding and consulting interest groups on the subject of net zero freshwater withdrawal 4. Encourages Network to do the same	The IT-organization has a clear policy that: 1. Measures its freshwater withdrawal per subset of the IT-organization 2. Adds more freshwater to its environment / (local) community than it takes out (often closed loop system fed by rainwater recovery and recycling used water) 3. Encourages finding, consulting and actively contributing to interest groups on the subject of being generative on freshwater 4. Encourages network to do the same

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q26. Which situation describes your organization best?

Land Conversion

A	B	C	D	E
The IT-organization does not think of, measure, compensate or limit its land conversion (land used for business ends)	The IT-organization limits its land conversion where this leads to a better short-term financial result (inherent motivation is more short-term profit) but has no clear policy that is about a bigger goal than its own financial gain	The IT-organization has a clear policy that: 1. Measures its land conversion (land used for business ends) 2. Compensates slightly for overshoot by (examples) a. Planting forest b. Financial construction / compensation	The IT-organization has a clear policy that: 1. Measures its land conversion (land used for business ends) per subset of the IT-organization 2. Limits its net land conversion to 0.051 ha per employee 3. Encourages finding and consulting interest groups on the subject of net zero land conversion 4. Encourages Network to do the same	The IT-organization has a clear policy that: 1. Measures its land conversion (land used for business ends) per department 2. Land conversion limited to below 0.051 ha per employee 3. Encourages finding, consulting and contributing to interest groups on the subject of net zero land conversion 4. Encourages Network to do the same

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q27. Which situation describes your organization best?

Biodiversity Loss

Here a difference is made between Species, Genetic, Ecosystem and Functional diversity.

- Species diversity
    - The unique collection of species living inside an ecosystem
- Genetic Diversity
    - Describes how closely related species within a single ecosystem are. If a large portion of/all members have similar genes the species has a low genetic diversity
- Ecosystem Diversity
    - A region can have a wide array of ecosystems or only a few or even one
- Functional Diversity
    - The way species behave, obtain resources and food

A	B	C	D	E
The IT-organization does not think of, measure, compensate or limit biodiversity loss it causes	The IT-organization protects some biodiversity, but only looks at species diversity and only when forced to do so to prevent fines or bad reputation that would be harmful for the financial growth, short term (inherent motivation is short-term financial gain)	The IT-organization has a clear policy that: 1. (Periodically) Analyses and assesses the species- and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) design 2. Relocates, removes or terminates as little species as possible	The IT-organization has a clear policy that: 1. (Periodically) Analyses and assesses the species-, genetic-, ecosystem- and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) (re-)design 2. Relocates as little species as possible 3. Removes or terminates no species that are in any way thought of as being even remotely close to endangered 4. Encourages finding and	The IT-organization has a clear policy that: 1. (Periodically) Analyses and assesses the species-, genetic, ecosystem and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) (re-)design 2. Periodically) Analyses and assesses the impact it has on species-, genetic, ecosystem and functional diversity of its (local) community and integrates the outcome into the business

	consulting interest groups on the subject of biodiversity (loss) 5. Encourages Network to do the same	3. Finds, introduces and takes good care of endangered species that are perfect for the owned or used (by IT-organization) workplace and land(scape) 4. Relocates, removes or terminates no species that are in any way thought of as being even remotely close to endangered 5. Encourages finding, consulting and actively contributing to interest groups on the subject of biodiversity loss 6. Encourages Network to do the same

- Situation A describes my organization best
- Situation B describes my organization best
- Situation C describes my organization best
- Situation D describes my organization best
- Situation E describes my organization best

Q28. If you would like your organization's own sustainability analysis leave an email (leave empty if you do not wish to receive the analysis)

Appendix VI - Checkmark table

Here a table can be found that can be filled in with (check)marks to indicate an IT-organization is at a certain maturity level and generate an overview of the developed situation.

	DO NOTHING (1)	DO WHAT PAYS NOW (2)	DO YOUR FAIR SHARE (3)	DO MISSION ZERO (4)	DO GENERATIVE (5)
PURPOSE					
GOVERNANCE					
NETWORKS					
OWNERSHIP					
FINANCE					
FOOD					
HEALTH					
EDUCATION					
INCOME & WORK					
PEACE & JUSTICE					
POLITICAL VOICE					
SOCIAL EQUITY					
GENDER EQUALITY					
HOUSING					
NETWORKS					
ENERGY					
WATER & SANITATION					
CLIMATE CHANGE					
OCEAN ACIDIFICATION					

NITROGEN & PHOSPHORUS LOADING					
FRESHWATER WITHDRAWALS					
LAND CONVERSION					
BIODIVERSITY LOSS					
OZONE LAYER DEPLETION					

Table 39 Checkmark Table - Maturity Overview As

Appendix VII – Specific Analysis - Design Traits & Doughnut Economics Aspects

Specifics

In this sub-chapter the interpretation per aspect of the Design Traits and Doughnut Economics is broken down.

Specifics – Design Traits

In this sub-chapter the interpretation and implication is broken down per aspect of the Design Traits.

Purpose

The purpose of the majority (55%) of organizations analyzed in this thesis is found in situation D and E, meaning that their purpose is to a bigger goal than just making profits and want to either reach net zero or generative and distributive (so, they have a sustainable purpose). Only a small number (25%) of all respondent's' organizations have an unsustainable purpose. Another smaller number (20%) is in an 'in between' phase meaning they have a living purpose but are still caught in degenerative thinking.

The average score is 3.45, meaning on average the purpose of organizations participating in this research is sustainable.

Governance

The governance of 45% of organizations analyzed in this thesis is found in situation D and E, meaning their governance is deemed sustainable, when looking at the opposite only 25% of organizations is deemed unsustainable (A & B) when looking at their governance. Whilst 30% is in an 'in between' phase (C) with a mix of metrics aimed to achieve (some) minimal sustainability goals and short-term financial gain.

This means the largest percentage of organizations is deemed sustainable and working towards net zero or long-term transformative action when looking at their governance. This can also be seen in the average score of 3.4, meaning on average the organizations participating in this study are found to be sustainable when looking at their governance.

Networks

The networks of 50% of all respondents is in the 'in between' phase (C), whilst 35% is deemed sustainable (D & E) and only 15% is deemed unsustainable. This means there is still quite a lot of uncertainty around the sustainability of networks of customers, suppliers and partners and might indicate that although purposes of organizations have changed the networks are still in the process of changing.

With an average score of 3.3 this is the lowest scoring design trait, yet still considered sustainable. This supports the earlier statement made about this design trait.

Ownership

Here we can see 50% of organizations ownership is considered sustainable, meaning it is in the hands of value-based investors, its employees or a founding family and commits to reaching net zero or ways in which to add benefits to not just themselves but their (larger) surroundings. While 45% is in the 'in between' phase (C), which at the least means the vast majority of organizations present in this research are willing to meet national goals, whilst only 5% is deemed unsustainable (B).

The average score of ownership is 3.75 (the highest score of all design traits) and shows that on average ownership is considered sustainable in this research.

Finance

The Finance of respondent's organizations is considered sustainable for 50% (D & E) whilst 35% is in the 'in between' phase (C) in which they will at least commit to minimum goals set by governments, only 15% (B) is considered unsustainable.

The average score of finance is 3.6, this means that on average organizations are at least willing and able to match national goals and/or have value driven shareholders.

Specifics – Doughnut Economics

In this sub-chapter the interpretation and implication per aspect of Doughnut Economics is broken down.

Food

The food aspect of 55% of organizations is in the phase where the organization either provide safe, nutritious, affordable food or locates itself near a source where safe, nutritious, affordable food can be purchased against a reasonable price and provides a pleasant place to consume it. Another 25% of organizations are found to be sustainable (D & E) and have a policy around food as well as sourcing food locally and limiting their output. 20% of the total is considered unsustainable, meaning they either do not concern themselves with affordability, the main driver for improvement is more income for the organization or they just do not think about food at all.

The average score of the food aspect is 3, one of the lowest scoring social sustainability aspects. But this does mean that, on average organizations are either just sustainable or just not sustainable. When comparing this with previous research at the national level, this is not a strange figure. In that research the kilocalories eaten per day, on average, is the indicator. The research states 2700 kcal per day is the bottom threshold, it states on average Dutch eat 3147 kcal per day per capita (O'Neill D. , Fanning, Lamb, & Steinberger, 2018). That would mean there is a slight difference in the outcome, however we are also not measuring the exact same thing, so that could account for that (small) difference.

Health

On health one can see that 50% of organizations (C) is in the 'in between' phase, meaning that the organization follows the law and possibly has some extra's to keep their senior staff fit and happy. Another 50% is considered sustainable (D & E), meaning they have a strong policy that provides extra healthcare benefits on top of Dutch law and analyzes the impact its activities have on its employees (and in the last maturity level also the local community).

The average score of the health aspect is 3.7, it is one of the highest scoring aspects. This means that on average health is considered sustainable in this research. And although the indicators and requirements that are used differ, and also the level at which this is measured differ (the national vs the IT-organizational level) both this research and previous research done by the university of Leeds find that the health aspect is at a good sustainability level in The Netherlands. The research done by Leeds University states on average Dutch people get 71.2 years of healthy life while the bottom threshold is 65 years. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Education

The education of 40% of organizations analyzed in this thesis is found in situation D and E, meaning their education is deemed sustainable. This is only a slightly bigger percentage than the percentage of unsustainable organizations, namely: 35% (B & A) who either only provide education when the organization needs it or does not provide education at all. Another 25% is located in C, which means that employees who ask for education will (or are likely) to get it, but you have to ask.

The average score of the education aspect in this research is 3.1, meaning it is considered sustainable but is one of the lower scoring social aspects. Although in both this research as research performed by the university of Leeds the level of education was found what would be called sustainable in this research, there is a little variation in the degree of sustainability. Where this research finds the education aspect only just sustainable, Leeds university finds this to a higher degree. This could however be explained because this is an adapted model which analyzes different indicators/requirements at a different level, the indicator the Leeds study analyzes is % enrolment in secondary school. The bottom threshold for this is 95 while the Dutch score 129.1. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Income & Work

Here we can see 70% of the income & work aspect of organizations is considered sustainable (D & E), meaning they pay at least a living, minimum wage and the organization has a written structure to indicate growth in work status, responsibility and wage whilst also at least looking at their own employees and analyzing the impact of the organization's actions on this income & work and making sure the situation at the very least does not worsen. Another 30% of the income & work aspect of organizations is in the 'in between' phase, meaning they pay a living, minimum wage but not much more than that.

The average score of the income & work aspect in this research is 3.9 and is the highest average score of all traits and aspects. This means that on average this aspect is considered sustainable. The high scoring of this aspect also has to do with the historical points mentioned in the overview. This also matches previous research done by the university of Leeds, showing The Netherlands have the highest score on income (although their indicator is % of population that earns above $1.90, so a lot of western countries have that). As well as having an employment score of 95.6 where the bottom threshold is 94%. The indicators in the Leeds study differs from the ones used here, but the general sentiment of the outcome is still the same. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Peace & Justice

45% of Peace and Justice respondents selected situation D and E and are therefore considered sustainable, meaning they at least feel very safe and treated fairly when it comes to disputes, as well as there being procedures, committees, councilors and the privacy is well handled. On the other side of the spectrum, 20% is considered unsustainable, meaning employees feel slightly safe or even unsafe and do not feel treated fairly. The motivation for providing any type of safety is short-term financial gain. Another 35% of respondents are in the 'in between' phase where employees feel safe and generally treated fairly.

The average score of the peace & justice aspect in this research is 3.4 and is therefore considered sustainable.

Political Voice

The political voice of 50% of organizations analyzed in this thesis is found in situation D and E, meaning their political voice is deemed sustainable and at least provides opportunity, framework, and funding for a works council and/or employees feel they have a strong voice in organizational policy and practices. Another 25% is in the 'in between' phase (C), meaning there are councilors (or someone designated as such) to collect feedback and employees feel they have at least some say in organizational policy. The last 25% is found in situation A and B and is considered unsustainable, this means employees feel they have a very limited or no voice on organizational policy and practices and reasons for accepting employee feedback are always about short-term financial gain or just not present.

The average score of the political voice in this research is 3.35, meaning it is considered sustainable on average and employees feel they at least have a voice in organizational policy and their feedback is being viewed and shared. This also matches research performed by the university of Leeds stating that the Dutch National Democratic Quality Index is at 1.3 whilst the bottom threshold (for what would be called sustainable in this thesis) is 0.8. Although once again it is not the exact same thing that is being measured the general sentiment of the outcome is the same, however the extent differs. This could be explained by the fact that the indicators used, and the level of analysis (national vs IT-organizational) are not the same. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Social Equity

50% of social equity respondents selected situation C, meaning they are in the 'in between' phase. This means organizations are matching national targets and employees feel treated equally including on their financial compensation. Another decent sized chunk comes from situation D and E with 45%, meaning they are considered sustainable and have a broad policy on equal opportunity and income equality, but also educated, informs and analyzes its own impact and tries to at least negate this. 10% of organizations within this study was found to be unsustainable (although none were scaled in the lowest maturity level), meaning that although people feel mostly treated as equals this is not always the case and they feel financial compensation is unequal to them or those around them.

The average score of the social equity aspect in this research is 3.55 and is therefore one of the highest scoring aspects. Meaning that on average organizations have social equity embedded in their policies, internal diversification is important and feel they are both treated equally as well as compensated fairly financially in regard to others. This also matches previous work done by the university of Leeds in sentiment, again not the same indicators were used in the research, but the same aspect was analyzed (although on different levels, the national vs the IT-organizational). In their research The Netherlands scores a 73.4 on the equality scale, the bottom threshold (for what would be defined as sustainable in this research) is 70. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Gender Equality

The gender equality of respondent's organizations is considered sustainable for 50% (D & E) meaning there is a clear policy as well as the consulting with and to interest groups and in the most extreme even with gender equality quotas. Whilst 40% is in the 'in between' phase (C) in which at least some binding moral rules are set and enforced, only 10% (B) is considered unsustainable, this means that there are guidelines for gender equality but no enforcement.

The average score of gender equality in this research is 3.75 and with that score is one of the highest scoring aspects. This means it is considered sustainable and on average there is a policy that focusses on equal access to education, healthcare and an enjoyable job for all genders as well as consulting with interest groups. Since this aspect is closely related to the social equity aspect, the same indicator in the Leeds University study applies. That indicator is the equality scale on which The Netherlands scores a 73.4 (the bottom threshold for what would be called sustainable in this research is 70) (O'Neill D. , Fanning, Lamb, & Steinberger, 2018). This means that in both studies The Netherlands obtained a score that would be defined as sustainable within this research.

Housing

The largest percentage of respondents picked option C here (45%), which means they feel the housing their organization provides is adequate but not amazing. Another 35% of respondents picked A or B, these are considered unsustainable, meaning that things like ventilation, heat/cool etc are below adequate or non-existent. Only 20% is definitely considered sustainable (D & E),

meaning they have a clear policy that makes sure there is good ventilation and heat/cool whilst also analyzing the impact the organization's actions has on this and at the very least compensate their negative actions.

The average housing score is 2.85 which makes it the second lowest scoring social aspect and meaning that within this research the housing is found as unsustainable on average. This means within the sample extra work needs to go into making workspaces better suited for the work that needs to be performed there and the people performing it.

Networks

Here we can see 40% of the networks aspect of organizations is considered sustainable (D & E), meaning that they provide (funding for) public transport and ways of remote communication, things like councilors for social support as well as actually analyzing the situation and making sure that its own actions do not lead to deterioration on this subject. Employees feel connected and in touch with their colleagues and in the highest maturity form also with their (local) community. Another 40% of organizations is considered in the 'in between' phase, meaning employees feel connected and in touch with their colleagues and there is some form of funding for public transport/communication.

The average networks score is 3.3 which on average makes it an average scoring aspect and is considered sustainable. This also matches research performed by the university of Leeds which, again, uses different indicators to measure something at a different level (national vs IT-organizational). However, the overarching idea/aspect still stands. The indicator that is used in that research is the % of people that can count on friends and family (Which is a form of social network which is something also included in this research as a requirement, namely: councilors who will help employees in organizations). The bottom threshold of this indicator used in the Leeds study is 90% whilst the Dutch score is 93.8 (meaning that -using terminology used in this research- it is considered sustainable in both studies). (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Energy

40% of all respondents stated their organization's energy aspect scored A or B, meaning it is not available for all and definitely is not generated cleanly. Another 45% of respondents rated their organizations in situation C, meaning energy is freely available and the organization generates some clean energy to reduce their footprint. Only 15% was found sustainable (D), meaning they generate enough energy to be energy neutral while energy is freely available.

The average score of the energy aspect is 2.5, which makes it the lowest scoring social aspect and means it is unsustainable and extra effort needs to be spent to make energy available whilst this energy is also generated by the organization. A good place to start is solar panel- and/or hydro solutions on housing as well as a clear policy to allow energy for all. The score of this aspect differs from previous research done by the university of Leeds. Once more, the indicators that are measured and the level those are measured at differ, but the same overarching thoughts apply.

The indicator the Leeds study uses is % of population with access to electricity (100% in The Netherlands, with a bottom threshold value of 95% for what would be called sustainable in this research) (O'Neill D. , Fanning, Lamb, & Steinberger, 2018), whilst requirements used in this research are more abundant and stringent. This means that the Leeds study finds that The Netherlands is doing well on the energy aspect whilst this research finds that it is actually one of the lower scoring (rated unsustainable) aspects of social sustainability in The Netherlands.

Water and Sanitation

We can see 55% of all respondents stated the 'in between' phase, C, as their answer, meaning that organizations provide clean water, toilets and soap to its employees and/or tries to generate a portion of their own water or compensates this water use by a financial construction. 25% of organization's water and sanitation is considered unsustainable as they score situation A or B, meaning motivation is either pure short-term financial gain or the organization does not provide some or any of these. Last, and also least: 20% of organizations was found to be sustainable, meaning they scored in situation D or E and at least comes to no deterioration to this basic human need.

The average score of this aspect is 3.05, this means that it is narrowly considered sustainable and that on average organizations in this research either generate some of their own water or compensate financially for their water usage. When compared to research performed by the university of Leeds, the extent of sustainability differs but the conclusion that both come to what would be called a sustainable rating within this research can be drawn with this research finding the water and sanitation aspect less sustainable than the Leeds study (although, once more: Different things are measured at different levels and this research has way more requirements than just a single indicator). The indicator used by the Leeds study is % of population with access to improved sanitation, with a bottom threshold of 95, The Netherlands scores a 100% on this. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Climate Change

55% of respondents rated that their organization in situation A or B, meaning the organizations are considered unsustainable on this aspect. This means that these organizations either do nothing or have small initiatives aimed at avoiding fines or boosting income. 35% of respondents rated their organization in the 'in between' phase C, meaning there is policy that limits CO_2 emissions to 0.272 tons per employee per year (and the organizations thereby meet the Paris accord measures). Only 10% of all organizations is considered sustainable as they picked situation D, which means there are achieving net zero emissions and encourages its network to do the same.

Climate Change is one of the most well-known ecological sustainability aspects (and when talking about sustainability most people think you are automatically talking about climate change) and it might seem surprising so few organizations within this research are considered sustainable. However, looking at the average score (2.3) this is the highest scoring ecological sustainability aspect, which shows the field of tension between the only recent shift towards ecological

sustainability and the attention this particular aspect of ecological sustainability has gotten. When compared to research performed by the university of Leeds it is noted that the findings in this research are slightly more positive towards this aspect than the findings of the Leeds study (which finds that an inhabitant of The Netherlands on average emits 13.3 tonnes of CO_2 per year whilst the bottom threshold is 1.6 and is thus 8.3 times too high, while this research finds that 45% of the respondents state their IT-organizations do at least emit less than the 0.272 tonnes of CO_2 per employee per year which is a number based on the yearly time spent at work and the bottom threshold of 1.6 used in the Leeds research) (O'Neill D. , Fanning, Lamb, & Steinberger, 2018). However, both studies find the climate change aspect is currently still at an unsustainable level.

Ocean Acidification

55% of respondents rated that their organization in situation A or B, meaning the organizations are considered unsustainable on this aspect. This means that these organizations either do nothing or have small initiatives aimed at avoiding fines or boosting income. 35% of respondents rated their organization in the 'in between' phase C, meaning there is policy that limits CO_2 emissions to 0.272 tons per employee per year (and the organizations thereby meet the Paris accord measures). Only 10% of all organizations is considered sustainable as they picked situation D, which means there are achieving net zero emissions and encourages its network to do the same.

The average score is 2.3 and even though that is the same as climate change and the causes of ocean acidification are also the same as climate change (CO_2) this aspect is a lot less well known. The phenomenon is however caused by the same causes as Climate Change (mainly CO_2 emissions) so the answer to both aspects is the same.

9.1.1.1.1.1 Ozone Layer Depletion

Here we can see 80% of people stated their organization in situation A or B, meaning the organization either does not limit or only slightly limits the use of substances that are bad for the ozone layer. Whilst only 15% is in the 'in between' stage (C), meaning there is clear policy that leads to measuring the output of harmful substances to the ozone layer and completely stops any chlorofluorocarbon and halons gas emissions while severely limiting the use and emission of hydrochlorofluorocarbon and bromine compounds. Only 5% is considered sustainable in this respect (E), meaning they measure all outputs and make sure none of it gets out as well as informing others and making sure information on the subject is gathered and shared both internally as externally.

The average score of the ozone layer depletion aspect in this research is 1.9, meaning it is one of the lowest scores across the board. This means that, according to the score, at best the output of harmful substances is only slightly limited. However, another explanation might be that there are a lot of difficult compound names that very little people know a lot about and therefore picked one of the lower maturity levels (because they had simply never really heard about it and therefore assumed the organization would not do much about it).

Nitrogen & Phosphorus Loading

80% of respondents selected either A or B, meaning their organizations are considered unsustainable on this subject. Meaning their organizations do not pay attention to this at all or only very little and only where it leads to an increased short-term financial result. 15% is in the 'in between' phase, meaning they are willing and able to meet the Dutch national goals on this subject. Only 5% of organizations is considered sustainable in this, meaning they emit fewer than 0.153kg of nitrogen per employee per year and does some type of sequestering.

The average score of the nitrogen & phosphorus loading aspect in this research is 1.65, meaning it is one of the lowest across the board. This seems strange, since this subject has been gaining traction both nationally and internationally as one of the leading causes of biodiversity loss. An explanation for its low score could be that people either do not know a lot about it and gave wrong information, another explanation is that the score is actually this low and a lot more effort needs to be made to get this up to an acceptable level.

When compared to a study done by the university of Leeds, we see The Netherlands scores low on this aspect in both studies and in both studies would not be what is called sustainable in this research (O'Neill D. W., Fanning, Lamb, & Steinberger, 2018). Meaning this matches what this previous study states.

Freshwater Withdrawals

60% of respondents selected either A or B, meaning their organizations are considered unsustainable on this subject. Meaning organizations either do not think to measure their freshwater withdrawals or only do so slightly (and with the motivation to cut costs). Another 30% is in the 'in between' phase (C), meaning they have a policy to measure their freshwater withdrawals and limiting the withdrawal of freshwater to 97.58 m^3 per employee, per year. Only 10% is considered sustainable (D), meaning their freshwater withdrawals are net zero (take out no more than is being put back and/or generated).

The average score of the freshwater withdrawals aspect in this research is 2.25 and is therefore not considered sustainable but it is one of the highest scoring ecological sustainability aspects. The fact that it is one of the highest scoring aspects in the ecological sustainability element of this research is not strange, when compared to research from the university of Leeds, their research states this is the only ecological aspect at which The Netherlands as a nation scores a passing grade. However, the data does not match (this aspect is considered unsustainable within this research) so, in future research, this is an area that could be looked at first. Reasons for this might be a non-generalizable number of replies to the survey or there might be an actual difference between the organizational image and the national image because one is a national approach aimed at citizens and this research downscales the model and approaches IT-organizations whilst indicators are also not exactly the same. (O'Neill D. , Fanning, Lamb, & Steinberger, 2018)

Land Conversion

75% of respondents selected either A or B, meaning their organizations are unsustainable on this aspect and either do not think of and/or measure their land conversion or their only interest is short-term financial gain. Another 20% is in the 'in between' phase (C), meaning they measure their land conversion and compensating for this through planting or financial compensation. Only 5% is considered sustainable, meaning the land conversion is limited to 0.051 ha per employee and its level of outward thinking and sharing of information is high.

The average score of the land conversion aspect in this research is 1.8, which is one of the lowest scores of all aspects. This means that the inherent motivation to do something about this is short-term profit and there is no coherent, documented policy about this. This means to boost their ecological sustainability within the Doughnut Economics model or in general, this should be addressed. Possible implications are building outward less and upward more (meaning less land will be converted) or repurposing land towards nature.

When compared to a study performed by the university of Leeds, both studies find that The Netherlands is what would be defined as unsustainable within this research on this aspect. However, the extent to which The Netherlands scores unsustainable on land conversion differs. This research comes to an average score of 1.8 whilst the Leeds study comes to 2.8 with their bottom threshold being set at 2.6 tonnes per year (meaning the border is transgressed by 0.2) (O'Neill D. , Fanning, Lamb, & Steinberger, 2018). This might once again be explained by the difference in indicators (the indicators used in this research are more elaborate and are adjusted to a different level, namely the IT-organizational level whilst the Leeds study focusses on the national level).

Biodiversity Loss

70% of respondents selected either A or B, meaning their organizations are unsustainable on this aspect and either do not think of and/or measure the biodiversity loss they cause. And in the cases they do, only look at species diversity. The main driver behind all of this is to prevent fines or seize an opportunity to generate short-term financial gain. 15% of respondents indicated their organizations are in the 'in between' level (C), meaning they periodically assess species and functional diversity and protects the biodiversity, only rarely removing or eradicating a species. Another 15% is sustainable, they analyze and assess the species-, genetic, ecosystem and functional diversity of its own real estate and land (to be) and integrates the outcome in workplace- and land(scape) (re-)design as well as analyzing the impact it has on the (local) community and negating these effects.

The average score of the biodiversity aspect of this research is 2.1, meaning it is considered unsustainable and is quite close to the overall average score of the ecological sustainability element. Since the entire ecological sustainability element scores low compared to the social element this is another aspect that needs to be addressed. Whilst climate change is getting a lot of attention, biodiversity is slowly starting to creep on the radar as well. The crisis that humanity might face on this front is quite dire and possibly more pressing than the climate change problem, but this has not seeped into the minds of decision makers as of yet. A global initiative is needed

to undo damage already done and prevent more damage from happening. And, since it is a government's first task to protect its citizens the government should intervene, set stringent goals and guard the process towards obtaining that goal vigilantly.

When compared to research by the university of Leeds this matches the trend, they come to an average score of 2.8, with a bottom threshold of 2.6 (EHANPP is an indicator that combines a lot of different aspects). Meaning this threshold is transgressed and biodiversity is rated unsustainable in The Netherlands, same as in this research (although in a slightly different degree).