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Degrowth and ICT, Connections and Contradictions: A Conceptual Framework and Attitude Study

Thesis MSc Business Informatics

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List of acronyms

ICT Information and Communications Technology

DoICT Degrowth of ICT

DfICT Degrowth for ICT

NACE Statistical classification of economic activities in the European Community

Abstract

In this paper we present a conceptual framework for classification of research concerning degrowth and ICT. The need for this framework stems from a lack of research uniting the two concepts on a conceptual level. In order to conceptualize this relationship, we look at common themes and topics in state-of-the-art literature. We combine this with an attitude study and a mapping study. The attitude study consists of focus groups, expert interviews and a survey based on the Q-sort method. It serves to provide context to the conceptual relationship between degrowth and ICT, as well as important directions for future lines of research. The mapping study consists of populating the conceptual framework by classifying relevant papers based on the developed method. The results from both studies are analyzed and synthesized in order to provide a comprehensive overview on the current state of the art, including the attitudes of people concerning degrowth and ICT. Highlights from among our results include recommendations for successful implementation of degrowth and ICT projects, alongside a general warning on the inherent connection and contradiction between using ICT to implement degrowth principles, and degrowing ICT.

Graphical abstract

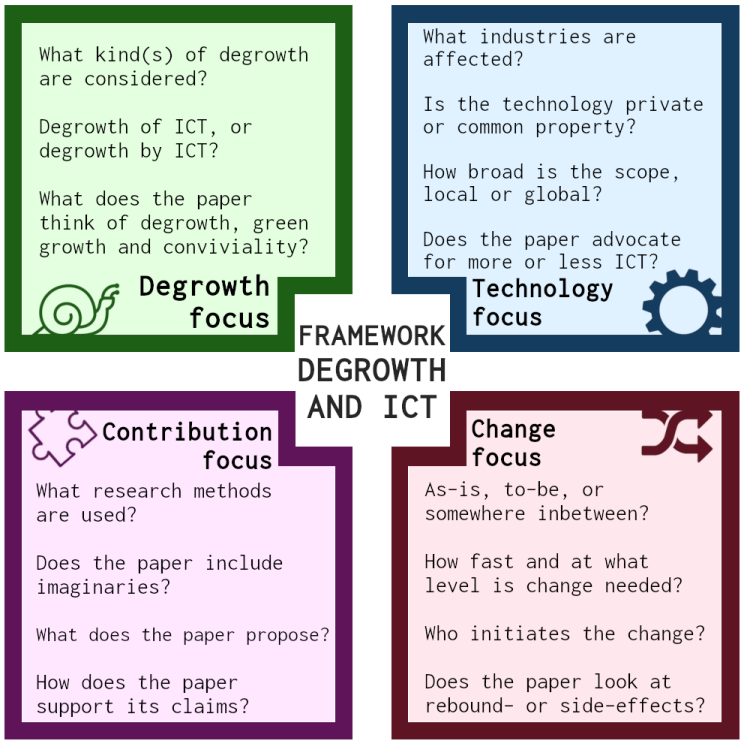

Figure 1: Graphical representation of the conceptual framework.

1 Introduction

Infinite growth in a finite world is a logical and practical impossibility. At surface level, this statement speaks for itself. This axiom is at the heart of the problems of capitalism, which strives for growth as an end-goal (Hickel, 2021). Corporations in a capitalist economy are subject to a growth imperative: the company (and thus the economy) must grow, or eventually go bankrupt (Gordon & Rosenthal, 2003). This economic growth is connected to our exponentially increasing exploitation of the natural world, breaching the limits of sustainability (Steffen et al., 2015), alongside an increasingly unequal and unjust distribution of the benefits and burdens of this growth (UNDESA, 2020). Any proposed solution to these problems should therefore be founded on systematic change, instead of fighting symptoms. A prominent alternative to this growth-oriented capitalistic system that has gained traction in the past years is degrowth.
Degrowth is an ideological concept and movement that critiques the global capitalist system which pursues growth at all costs, causing human exploitation and environmental destruction. The degrowth movement of activists and researchers advocate for societies that prioritize social and ecological well-being instead of corporate profits, over-production and excess consumption (Demaria et al., 2013). The consequences of growth for the sake of growth are becoming more apparent every day, and the recently released Intergovernmental Panel on Climate Change (IPCC) report on mitigating climate change urging for drastic action (IPCC, 2022). The report of the IPCC working group 3 cautions against unbridled growth, mentioning degrowth by name in the full report. In this light, degrowth presents itself as a viable and desirable way to restructure society for the betterment of humanity and the planet.

The use of ICT in making everything better and faster push us away from the world we live in, as corporate profits soar and ecosystems crumble (Healy, 2020), (Viitanen & Kingston, 2014). The ICT that pervades our lives is inextricably connected to the these problems, but perhaps it can also be part of the solution.
To find out how, we must understand the complex relation between degrowth and ICT. There is a growing body of research in the application of degrowth principles with respect to technological advances which served as an inspiration for this framework: Kerschner et al. (2018) and March (2018). There is also high-level research on the attitude of people towards degrowth as a whole by Ančić & Domazet (2015), but there is little to no high-level research on the intersections between degrowth and ICT.
Our results will contribute to the understanding of the relation between degrowth and ICT, and highlight important areas for current and future research.

1.1 Research objectives

For this research, we use the definition of degrowth as mentioned in section 1. Defining ICT is a difficult task, as asserted by Zuppo (2012). For the purposes of this research, we define ICT to be any (wholly or partly) digital technology that stores, processes, uses, or communicates data (information) in any shape. The first main objective of this research is to increase the understanding of the current state of research on degrowth and ICT. It is our aim of providing a comprehensive framework which will be used to this effect. We choose to design a conceptual framework that allows for further extension so that it remains relevant for future research. The design and validation of this framework will force us to conceptualize the relationship between degrowth and ICT, and provide theories which support these conceptualizations.
The second main research objective is to gauge public and expert attitudes towards the relationship between degrowth and ICT. We do this to ground the framework in the

real world and to provide context to the literary findings provided by mapping relevant research using the framework.
These opinions and attitudes, combined with the literature overview will provide valuable insight into the overall relevance of research and highlight important topics. The framework can also serve as guidelines for practical applications concerning degrowth and ICT. This is because of two reasons: combining literature and attitudes will help in delineating and forming imaginaries concerning the two concepts, which are a vital part of successful practical implementation. Imaginaries Sartre (1940) are collections of shared norms, values and institutions which we use to construct our view on reality and the future. March 2018 asserts that important aim for the degrowth movement is to insert the principles of degrowth into these (technological) imaginaries. Results of this research will also help to delineate in which contexts practical implementation is lacking or abundant.

1.2 Research questions

In order to formalise the research objectives, they are encapsulated in the following research questions:

- ***RQ1:*** *What are the attitudes of people towards (i) degrowth and (ii) the relationship between degrowth and ICT?*
- ***RQ2:*** *How can we conceptualize the relationship between degrowth and ICT, and the research around it?*
- ***RQ3:*** *What has been researched so far about the relationship between degrowth and ICT, in the light of the conceptual framework?*

1.3 Contributions

With this project, we contribute firstly an extendable and appropriate conceptual framework for classifying research on degrowth and ICT. This framework can be used by the degrowth community and ICT experts in categorizing their research or practical applications and placing them in the wider context of degrowth and ICT. Secondly, we provide an overview of (expert and general) attitudes towards degrowth and ICT. These attitudes can be taken into account when designing and executing ICT projects with degrowth principles, or degrowth projects that use ICT solutions. Thirdly, we provide recommendations and insights for the degrowth community on the relationship between degrowth and ICT, highlighting areas that require more research or that have been thoroughly explored. These highlighted areas of high and low interest also serve as inspiration and boundaries for real-world implementations of ICT and degrowth projects.

2 Research method

In this section, we outline the methods used in this research and how they allow us to answer the research questions and fulfill the research objectives. We use the sectioned Process Deliverable Diagram (PDD) of the research method to illustrate the process. For legibility we exclude the deliverable side of the diagram. The full PDD including deliverables can be seen in Figure 2.

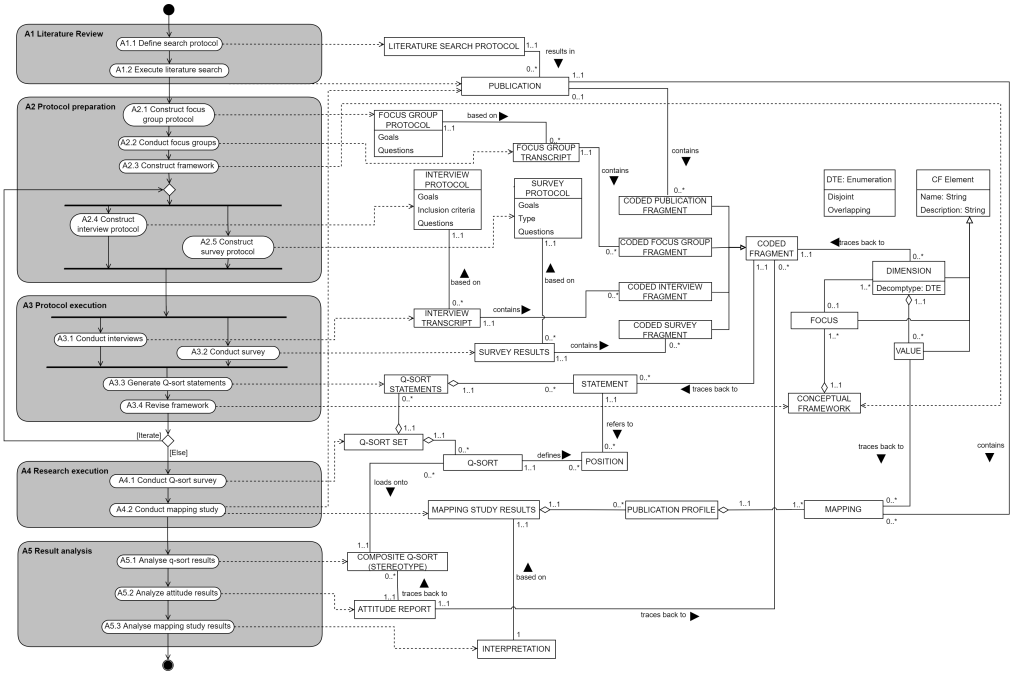

Figure 2: Process-deliverable diagram of the research method including deliverables.

2.1 A1: Literature review

See Figure 3 for the relevant section of the PDD.
In the first step of the research, we define a literature search protocol that allows us to find relevant papers that fit our criteria (activity A1.1). This corpus both provides background information that forms the foundation of the conceptual framework and will be used during the mapping study. The literature search protocol and a summary of the search results of activity A2.2 can be found in appendix A. The main criteria for the papers that are included in the corpus of the mapping study is that the paper considers ICT (as defined in section 1.1), and that it mentions the term degrowth. This is because a publication can embody the principles of degrowth, but does not explicitly mention the term. Judging whether or not this paper is aligned with the degrowth movement is difficult, and this can introduce ambiguity and reduce replicability.

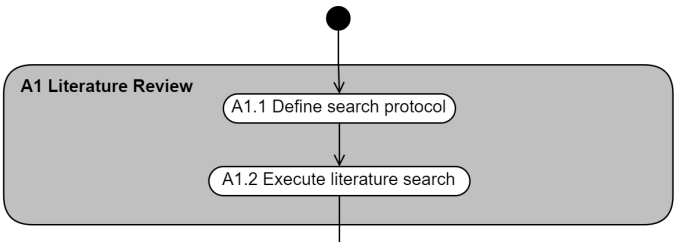

Figure 3: Process diagram of the research method part 1 of 4.

2.2 A2 & A3: Protocol preparation & execution

See Figure 4 for the relevant section of the PDD.
As a precursor to the attitude study and framework construction, we conduct a few focus groups. These focus groups are a tool that allow us to gather the attitude of people towards degrowth and ICT. The protocols for the focus group consist of questions that will spark a discussion among the participants (activity A2.1). We analyze these discussions as input for the attitude analysis. The focus group protocol for activity A2.2 can be found in appendix B.
The first version of the conceptual framework was constructed using the literature and results from the focus groups (activity A2.3). The foundation of this first version was a number of dimensions. These dimensions were identified based on topics subject to consensus or disagreement between different sources (from both literature and the focus groups), or important recommendations in publications that inspired this project (seed papers). An overview of the framework is presented in section 4. The second part of the research is an iterative process, as represented in Figure 4. We construct the interview and survey protocols (activities A2.4 and A2.5) based on relevant literature and the current version of the framework. This allows us to use the data from the attitude study to refine the conceptual framework (activity A3.4). We conduct interviews with experts from the degrowth community (activity A3.1). The interviews will be structured as to fulfill both interview goals, so they roughly consist of two parts. In one part we will poll the attitude of the interviewee towards degrowth and ICT, and in the other part we present the framework and ask questions to refine it. The interview protocol can be found in appendix C.
In addition to this, we conduct a traditional survey on the online forum Reddit (activity A2.3). Reddit exists as seperate communities, each with their own rules. Therefore, each post is based on those rules. The entire survey protocol including an extensive description of the types, the selected subreddits and the exact posts per subreddit can be found in appendix D. The answers to the open questions are used to add to the Q-set concourse, and to the results of the attitude study in general. The answers to the closed questions are used to evaluate the statements in the Q-set, and can be used to supplement the insights gained by analysis of the attitude study results in the last part of the research.
Here, we also define the set of statements (Q-set) that is used within the Q-methodology (explained in the next section, 2.3, activity A3.3). The Q-set is constructed using excerpts from research publications, grey literature, and our interviews, focus groups and survey data. Statements are generalizations of important concepts and topics within the degrowth and ICT scope. Relevant excerpts from these sources are the concourse of the Q-set. The statements are diverse, meant to cover many different aspects of, and perspectives on degrowth and ICT, and include important issues that emerge during interviews or focus groups.

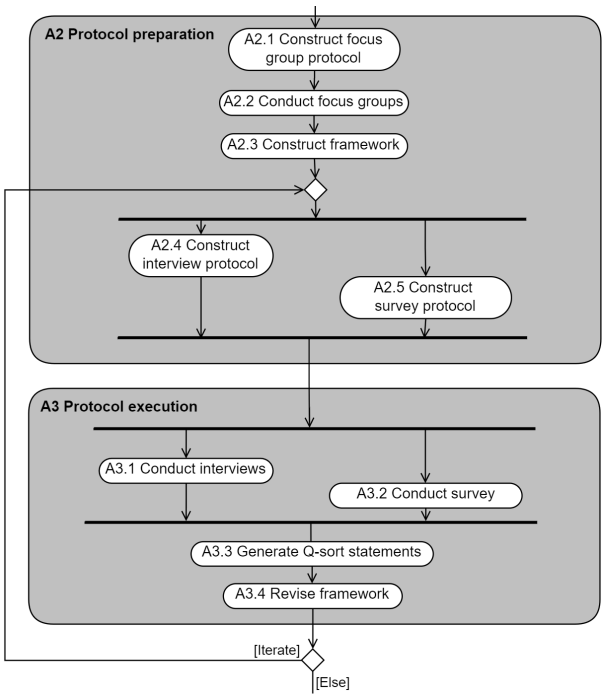

Figure 4: Process diagram of the research method part 2 of 4.

2.3 A4: Research execution

See Figure 5 for the relevant section of the PDD.
We end the iterative process of refining and validating both the framework and Q-sort statements when we are satisfied that additional interviews or focus groups will not add or change anything major to either artifact. The resulting framework presents the answer to **RQ2**.
We also poll peoples' opinion on the subjects using Q-methodology, constructed using the guidelines in Watts & Stenner (2005) (Activity A4.1). The Q-methodology is a method of collecting opinions and attitudes of participants through sorting a number of statements on a discrete scale, based on how much they (dis)agree with each statement. We use a set of 33 different statements (the Q-set, see 2.2) and a seven point (-3 to +3) scale for this process. The Q-sort has inherent advantages over a more traditional survey that make it a good fit for the attitude study. These advantages include that the methodology allows people to give their opinion based on the (relation between) pre-generated statements, this allows them to express their opinions more honestly and in a more nuanced than if they were to think of their own statements, or if they were assessing statements separately. Also, the Q-sort generates both quantitative and qualitative data (in the form of "thinking aloud" during the sorting, and a short post-sorting interview).
To ensure that many different perspectives are represented, the participants will be sampled selectively to represent general attitudes of different kinds of people (experts and laypeople, pro-degrowth and anti-degrowth etc), instead of one specific subset of the population. It is therefore important that the Q-set does not include statements that require extensive prior knowledge to understand.
Watts & Stenner (2005) recommends that the amount of participants is roughly equal to the number of statements in the Q-set. The Q-sort protocol and the Q-set concourse

is included in appendix E. In the next part of the research, this data can be matched to both parts of the attitude study, increasing the quality of the conclusions. Generalizing the data produced by sorting the statements will result in multiple statistical stereotypes or *factors*. These factors can be matched to the qualitative data derived from the expert interviews and focus groups, allowing us to clearly identify and validate argument and attitude trends in the data. For the analysis we will use the KADE tool version 1.2.1, an open-source Q-sort analyzer developed by Banasick (2019).

The mapping study will be conducted using the conceptual framework. A mapping study is a defined method to systematically create a "map" (i.e. overview) of a certain research field by using a classification scheme, in order to determine the coverage of topics within this research field (Perryman, 2016), (Petersen et al., 2008). In this case, the conceptual framework described in 4 is used as a classification scheme. The input for this study is the body of work found through the literature search. This will also include any papers we encounter during other phases of the research that fit the search criteria. Mapping a paper consists of reading the input, and assigning attributes to it according to the dimensions and values of the classification method.

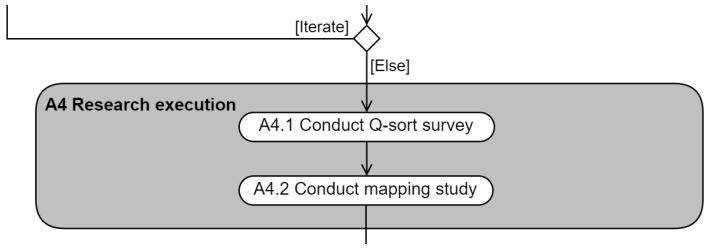

Figure 5: Process diagram of the research method part 3 of 4.

2.4 A5: Result analysis

See Figure 6 for the relevant section of the PDD.
The last part of the research consists of analyzing the results of the mapping study and attitude studies. First, we analyze the data provided by the Q-sort method and identify the factors, which are then subjected to thorough analysis (activity A5.1). We combine these results with qualitative data from interviews and focus groups. These results and interpretations form the attitude report and answer **RQ1** (activity A5.2). We then use this report in the analysis of the mapping study, in which we look what is being researched concerning degrowth and ICT in the light of the conceptual framework (activity A5.3). This last analysis will combine all aspects of the research and provide an answer to **RQ3**. See Table 2.4 for the method steps that are involved in answering each individual research question.

Table 1: Associated method activities per research question.

Research question	**Related research method activities**
RQ1	A2.2, A2.3, A2.4, A3.1, A3.2, A3.3, A3.4, A4.1, A5.1, A5.2
RQ2	A2.1, A3.5
RQ3	A1.1, A1.2, A4.2, A5.3

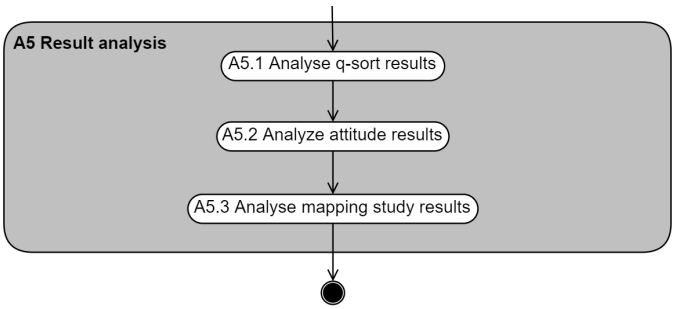

Figure 6: Process diagram of the research method part 4 of 4.

2.5 Method synthesis

Figures 7 and 8 outline the different parts of the research and illustrate how they interact during the different activities outlined in the PDD.

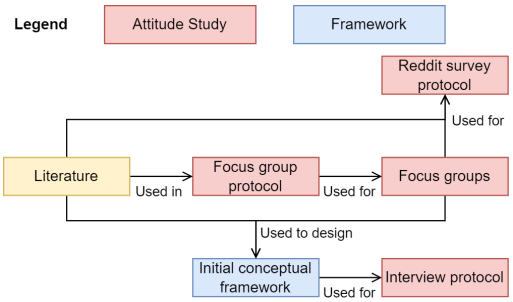

Figure 7: Diagram of the interaction between parts of the research method A1, A2.

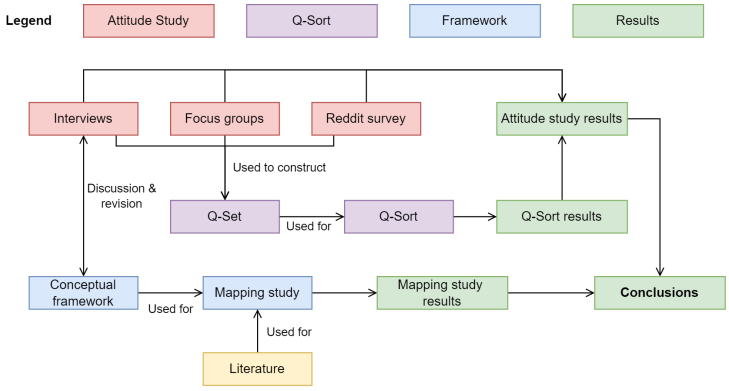

Figure 8: Diagram of the interaction between parts of the research method A3, A4, A5.

3 Literature Review

3.1 Degrowth

The central tenet of degrowth can be formalised as 'reducing our impact on the environment to a level within sustainable limits through lowering global production and

demand by shifting societal, corporate, and political norms and values from striving for more welfare to striving for more well-being'. Neoliberal economic paradigm dictate that more welfare (meaning increasing revenue, growing customer bases etc.) is the ultimate goal of all companies (Gordon & Rosenthal, 2003), and increased well-being is a side-effect that follows welfare. Degrowth theory asserts that this economic growth for the sake of growth has unacceptable environmental and social consequences. By its nature, degrowth confronts neoliberal and capitalist dogma through advocating radical change Demaria et al. (2013). The application of degrowth principles involve policies of sufficiency, and breaking away from the artificial scarcity inherent in capitalism (Hickel, 2019). A groundbreaking paper that brought these ideas to the attention of the scientific community was the 1972 Limits to Growth report by Meadows et al. (1972). This paper used computer models to solidify the impact that global economic growth was having on the natural world. This paper has since been revisited many times, most notably by Steffen et al. (2015). This paper proposed nine planetary boundaries (such as climate change and ocean acidification) that should form strict limits on how we form and expand our economy and society as a whole. The concept of doughnut-economics, also known the Safe and Just Space (SJS) framework is another example that embodies planetary boundaries (Raworth, 2012). Around the publication of Limits to Growth, economic philosophers such as E.F. Schumacher and Nicholas Georgescu-Roegen were analyzing contemporary economic paradigms and concluding that they did not take the exploitation of the natural world into account (Schumacher, 1973) (Georgescu-Roegen, 1971). Since then, the movement has only grown. The focus has shifted however, from a critique of the current economic systems in place towards building alternatives for a better future. As mentioned, while the degrowth movement has its roots in the early 2000's, its ideas and principles were first formulated decades before the term was coined. The start of the movement in 2002 heralded an increase in research and activist initiatives. Degrowth has been proposed as a solution to many problems since then, including increasingly technological problems. These are large-scale problems such as technology-induced rebound effects (see 3.3) (Schneider, 2008), hyperintelligent AI (Pueyo, 2018), smart cities March (2018), and energy-intensive internet usage (Abbing, 2021).

3.2 Degrowth & technology

Economic growth or capitalism and technological innovation are usually mentioned in the same breath. Any response or alternative to the former should therefore include the latter. An important and early concept is that of *conviviality* as described by Ivan Illich, a contemporary of Schumacher and Georgescu-Roegen (Illich & Lang, 1973). He describes convivial tools as "modern technologies [that] serve politically interrelated individuals rather than managers". This perspective on technology is aligned with degrowth principles. Convivial technology shortens the distance between producer and consumer, and puts focus on the value of the technology in human context instead of an economical context. Conviviality as a quality of technology has therefore readily been accepted as essential by the degrowth community (Samerski, 2018), (Kallis et al., 2018). Further important qualities of technology can be found in the title of a special issue on degrowth published in 2018. Alongside *convivial* there are: *feasible* (fully known, and able to be constructed and operated within time and other conditions), *viable* (sustainable in the sense that it can keep going indefinitely without harming the environment), and *appropriate* ("developed and maintained with local materials and are repairable and adaptable without the help of external experts") (Kerschner et al., 2018). An expression of how technology affects environmental impact is the famous $I = P \cdot A \cdot T$ equation (Ehrlich & Holdren, 1971), (Chertow, 2000). In this formula, environmental impact (I) is a product of population (P), affluence (A) and technology

(T). As such, any increase in the use of technology will result in an increase of the environmental impact. However, lowering energy useage, material usage by increasing efficiency or innovation will reduce the impact. This reduction is subject to rebound effects as will be discussed in section 3.3. Degrowth is mainly concerned with lowering or even removing the affluence factor in the IPAT equation, but we assert that a focus on the technology factor is increasingly important, as the amount of our lives that is interwoven with technology (especially ICT) grows on a daily basis (Belkhir & Elmeligi, 2018). Degrowth and most other (aligned or unaligned) concepts that grapple with the IPAT equation assume a continuing growth of the population factor.
According to Freitag et al. (2021) between 2 and 4% of global greenhouse gas emissions are caused by ICT and is projected to grow to as much as 14% in the next 20 years (Belkhir & Elmeligi, 2018). Considering drastic action is required to lower emissions enough to remain below a global warming level of 1.5 degrees C (Raftery et al., 2017), degrowing the amount and nature of our ICT consumption and production is vital. Simply running datacentres on renewable energy will not be enough, as Raftery et al. (2017) asserts that rising energy demand is outpacing the creation of renewable energy sources. As mentioned before, there has been quite some research about how degrowth and technology as a whole fit together on a meta-analysis level (Kerschner et al., 2018), (Pansera et al., 2019), and perspectives on ICT-led imaginaries by March (2018). These papers underline the fact that from a degrowth perspective the individual technological innovations do not matter as much as the underlying systematic and cultural values that determine what we do with those innovations. It is important to take this into account when examining the relationship between degrowth and ICT.

3.3 Rebound effects & dematerialization

Rebound effects occur when a new or improved technology is introduced, increasing efficiency. With this increase in efficiency comes a reduction in material and energy usage, but this reduction is offset or even outright cancelled out by rebound effects that occur, driving up material and energy usage. This effect, also known as Jevons' Paradox, was first noticed when the usage of coal in England went up when new steam engines were invented during the first revolution. Coal consumption predictions went down, but Jevons (1866) calculated that they went up. Van den Bergh (2011a) formulates four fundamental reasons for this effect. 1: increased technological efficiency will lower the T factor in the $I = P \cdot A \cdot T$ equation mentioned in section 3.2. However, without enforcing limits on the left-hand side compensatory increases in other factors the right-hand side (A and P) will diminish the lowering of I (Alcott, 2010). 2: Efficiency gains relax physical and economic limits of consumption and exploitation. Easing these limits will allow the economic ecosystem to expand. 3: An increase of efficiency in general purpose technologies (GPTs) induces general economic growth (Lipsey et al., 2005). This economic growth allows for more consumption (owing to higher earnings, newly created industry sectors and such) which in turn drives up consumption. This is a basic truth of market economies. This increased production will consume more resources and energy. 4: A less emphasized reason for rebound effects is the relation of overall efficiency gains to the bounded rationality of the actors involved. This rationality is employed when justifying behaviour related to consumption, and an increase in efficiency (combined with an increase in complexity that usually follows technological innovation) confuses or obscures this rationality.
Santarius (2012) examined the causes more closely, and defines three. 1: the direct rebound effect "which is manifested in increased demand for the same product or service". This is linked to increased availability or reduction in the price of usage. 2: the indirect rebound effect, "expressed in increased demand for different products or

services." Changing an existing product (such as buying a smaller car), might lead to different behaviour (more air travel). 3: the structural or macro-economic rebound effect. Reducing demand will lead to a lowering of prices which allows for more usage of the product or increased expansion in other energy-using sectors. A refinement of this paradox is the Khazzoom-Brookes postulate. Khazzoom (1980) determined that mandating efficiency standards using mechanical calculation would increase the energy use of household appliances, outpacing any efficiency gains made by imposing the standards. This extreme form of rebound effect is also known as a backfire effect. Santarius (2012) estimates that due to the occurrence of rebound and backfire effects, gains made in reducing consumption by any means are reduced by half.
We can extrapolate this to ICT and its applications. Investing in ICT applications can improve business efficiency (Castiglione & Infante, 2014), and labor productivity (Hilty, 2015). However, according to Hilty (2015), resource efficiency has not been improved in such drastic ways. Considering that ICT is mostly implemented in industries to increase efficiency, research into degrowth by ICT should take these rebound effects into account, as they are vital for a long-term sustainable economic paradigm, as stated by Nørgård & Xue (2016). In the application of degrowth principles by ICT and for ICT, rebound effects will strongly affect the sustainability benefits and should be taken into account. A similar effect can be seen in the effort to dematerialize industries through use of ICT. Where one might expect resource use to go down when using ICT to innovate and replace traditional (more resource intensive) production methods or (parts of) supply chains, such a trend seems unlikely to occur. Rieger (2021) finds no link between ICT use and dematerialization in Europe, when analyzing data between 2005 and 2017. Coroama et al. (2015) mentions that "To achieve the dematerialization potential of new electronic media solutions, their efficiency needs to be combined with sufficiency". This, while not mentioning degrowth, is perfectly aligned with the degrowth principles of frugal abundance (Latouche, 2014)

3.4 Attitudes towards degrowth

The attitudes of people towards degrowth or degrowth principles have been researched previously. Ančić & Domazet (2015) describes how people have generally positive attitudes towards post- or degrowth thinking, but it the implementation of such ideas differ across countries and cultures. Lehmann et al. (2022) notes that German sustainability experts are positive towards policies beyond growth, even more so when they have more knowledge of the subject. However, most favor a-growth or post-growth over degrowth. To wit, post-growth is another scientific movement similar to degrowth: As a concept, degrowth and post-growth are quite similar, but post-growth seeks to build on the working parts of the current system while fixing or replacing the 'broken' parts, while degrowth seeks to steer away from capitalism entirely, as mentioned by Daly (1996). There is another concept mentioned in Lehmann et al. (2022) that is widely popular: green growth. Green growth is based on the ecomodernist notion that we can keep growing the economy (or more specifically, GDP) if we manage to decouple this growth from the subsequent growth of ecological exploitation, through efficiency gains and technological innovation. Green growth is often proposed as a counter-argument to degrowth, with the intent of being able to keep the economy growing with all positives of that process intact (Nørgård & Xue, 2016). The idea that we can eventually replace natural and human capital with technological innovations is also known as the cornucopian paradigm (Ayres, 1993). These notions might affect the attitude of people towards degrowth and related concepts according to Capasso (2021), in the sense that they might disregard these concepts more easily since cornucopianism is more aligned with the current status quo. Green growth (meaning increasing the size of the economy

while decreasing environmental impact) as a possibility has been refuted by empirical research, including a comprehensive meta-analysis of 835 studies by Haberl et al. (2020), and studies by Kerschner & O'Neill (2015), Ward et al. (2016) and Parrique et al. (2019). Degrowth as a movement refutes the possibility of green growth acting as a panacea, state Kerschner et al. (2018). Important findings in aforementioned attitude studies were that people are hardly opposed to the notion that current economic policies should favour well-being instead of welfare, but the degrowth term as a label for these principles might negatively effect emotional connotation (Drews & Reese, 2018). This research can be seen in the broad context of growing support for sustainability, as a result of growing ecological consciousness. It remains important to note that sustainability improvements (especially green growth) cannot be seen as degrowth and as such we consider the use of the term degrowth to be important.

4 Conceptual Framework

In this section we present the conceptual framework, as constructed using data from the literature search and preliminary attitude studies. The data relations can be seen in Figure 9. The framework is used to classify papers, according to the dimensions below. A **dimension** is a specific analytical perspective by which a paper can be viewed and classified. The dimension values are all the options a reviewer can assign to a paper when analyzing from the perspective of a given dimension. The full collection of associated values of a given paper is the profile of that paper.
The dimensions and values are constructed based on an analysis trends and overlapping concepts within the existing body of literature concerning degrowth and ICT. This analysis is supplemented by opinions and feedback provided by participants in the attitude study. A dimension or value was added or expanded if it covered a (subsection of) an intersection between the two concepts that was not covered by the existing framework. We divide the dimensions in five broad categories, referred to as a focus. These are: degrowth focus, change focus, technology focus, contribution focus and research focus.

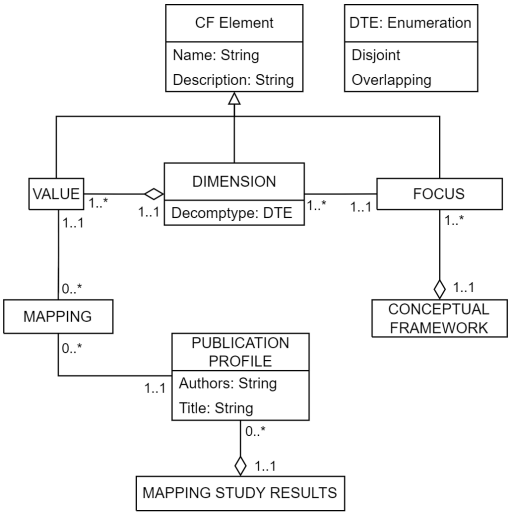

Figure 9: Section of the PDD detailing deliverable relations for the framework.

4.1 Framework Dimensions

Many of the dimensions are inspired by the work of Kerschner et al. (2018) and Pansera et al. (2019). The following is a list of all dimensions that make up the framework with their possible values. Included is a brief explanation of the dimensions and a table explaining the values. In addition to the dimensions, we record the authors (by last name, separating duplicates with initials), title, publishing year and location (conference, journal etc.) of the paper, as well as the country of affiliation of each author.

4.1.1 Degrowth focus

The degrowth focus contains the dimensions that are aimed at classifying the aspects of the paper concerning degrowth and the implementation of its principles. This focus contains five dimensions.

Relational direction
The relational direction of the paper describes what aspect of the relationship between the two concepts is examined in the paper. A paper might have multiple relationship focuses. This dimension was introduced in, and refined by the focus group sessions on 19/10/21. It is also inspired by the classifications used in related fields of study, such as greening of ICT versus greening by ICT (van Hoorik et al., 2010), or sustainability of ICT versus sustainability by ICT (Hilty & Aebischer, 2015).

Value	Description
Degrowth of ICT (DoICT)	The paper discusses applying degrowth principles to ICT.
Degrowth by ICT (DbICT)	The paper discusses using ICT to apply degrowth principles in other industries.

Type(s) of degrowth
We look at what the result of applying degrowth principles the research is pointed towards. A type is defined by the ends towards which it strives. Multiple types can be considered in a single paper. Types and quotes from: Van den Bergh (2011b).

Value	Description
GDP	The theory and practices in the paper strive for a reduction of GDP growth, or GDP shrinkage.
Consumption	The theory and practices in the paper strive "for a reduction in the amount of consumption, however measured. Such a strategy is then hoped to translate into less resource use and less pollution"
Work-time	The theory and practices in the paper strive to reduce the amount of time people spend at work, so they have more time for leisure, education or community service.
Radical	Radical degrowth "may involve changes in values, ethics, preferences, financial systems, markets (versus informal exchange), work and labor, the role of money, or even profit-making and ownership." Also "an escape from capitalism".
Physical	The theory and practices in the paper strive "for a reduction of the physical size of the economy, notably in terms of resource use and polluting emission. Such degrowth is then aimed to lead to an environmentally sustainable economy or steady-state economy."
Agrowth	A paper can consider agrowth, defined as the complete abandonment of GDP as an indicator of progress, or an indifference or neutrality towards economic growth.

Valence
The valence of the paper represents the overall sentiment towards the relationship between degrowth and ICT. This dimension was named as such to prevent confusion with the attitude analysis part of this research. This dimension was inspired by this article on the portrayal of degrowth in the press by Pringle (2021). The values are inclusive, so a paper can include none, either or both valences.

Value	Description
Positive	This paper has a positive disposition towards degrowth & ICT, this does not mean it is not critical of the concept.
Negative	The paper has a negative disposition towards degrowth and ICT, dismissing its usefulness in context or concluding that the concepts affect each other negatively.

Green growth valence
As discussed in section 3.4, the concept of green growth might affect the attitude of people towards degrowth. To include this in the framework, this dimension identifies the valence (overall sentiment) of the paper towards green growth. This dimension was inspired by (degrowth) literature concerning green growth, most notably the work by K. Kerschner & O'Neill (2015). The values are inclusive, so a paper can include none, either or both valences.

Value	Description
Positive	This paper has a positive disposition towards green growth, or considers it a possibility to use (for instance) ICT to grow the economy while lowering environmental impact.
Negative	The paper has a negative disposition towards green growth, dismissing the possibility of it or related notions.

Conviviality valence
As discussed in section 3.2, convivial tools are supportive of degrowth principles. As we extend this notion of conviviality to ICT, we feel it is important to analyze if conviviality as an aspect of ICT is being researched. This dimension identifies the valence (overall sentiment) of the paper towards the principles of conviviality (as defined in Illich & Lang (1973). This dimension was inspired by the work of Ivan Illich, and included based on the responses to Q-sort statement 16 (see section 5.2. The values are inclusive, so a paper can include none, either or both valences.

Value	Description
Positive	This paper has a positive disposition towards the principles of conviviality, either implicitly by denouncing ICT designed for managers or being supportive of ICT designed for "interrelated individuals", or explicitly by naming the concept.
Negative	The paper has a negative disposition towards the principles of conviviality. Either by implicitly supporting ICT designed for managers or explicitly by naming the concept.

4.1.2 Change focus

The change focus contains the dimensions that concern the effects of implementing the changes that a paper proposes. These changes have a scale and a scope, within which they operate and effect actual change. This focus contains six dimensions.

Type of change
The type of change is a meta-attribute of the proposed theory or practices in the paper. the type of change is concerned with the temporal scope of the change.

Value	Description
Gradual	Gradual change is characterized by incrementally increasing the efficiency or slightly changing procedures in the currently paradigmatic system(s).
Radical	Radical change is characterized by rapid paradigm shifts or large-scale changes in quick succession.

Scope of change
The scope of change is the societal level at which the theories or practices in a paper are applied. The scope of change can encompass more than one value. Inspired by the mini-lecture by professor C. Rammelt (2020).

Value	Description
Individual	The application level concerns personal behaviour, values and habits.
Interpersonal	The application level concerns the relationship and interaction between individuals.
Institutional	The application level concerns all individuals within a certain corporation, organization or movement.
Systemic	This application level concerns all individuals participating in a societal or industrial system.
Cultural	This application level transcends individuals, and concerns certain cultural aspects of a specific culture or interaction within cultures.

Transition
The transition represents the temporal scope of the research. The theories and practices outlined in the paper can be applied to current situations, or outline (un)desirable future situations. In both cases, the paper can also outline intermediate states.This dimension is based on Escobar (2015).

Value	Description
As-is	The paper focuses on the current situation, and theories and practices are aimed at what can happen.
To-be	The paper includes one or more hypothetical futures, either desirable or undesirable and what steps should be taken to reach this future situation.
Intermediates	The paper describes specific situations between the present and the future. These situations should be described in some detail, and could include the path to reach (or avoid) them.

Change initiator
A central concern of degrowth principles is reducing the global supply and demand of products. This has to be carefully balanced, as both sides need to keep pace with each other if a downward trend is to be sustained. The change can be initiated by policy-makers or (conglomerates of) corporations or by consumers or society in general. This dimension is inspired by general degrowth literature, especially the book Less is More

by Hickel (2021).

Value	Description
Top-down	The degrowth principles are applied from the producer or governmental side of the balance.
Bottom-up	The degrowth principles are applied from the consumer side of the balance or more broadly by society in general.

Side effects
This dimension looks at possible side effects or externalities of applying degrowth principles that are included in the paper or if active monitoring for these effects is proposed. This dimension has one value representing yes/no.

Value	Description
Yes	The paper describes possible side-effects or externalities arising from the implementation of degrowth principles in ICT, or by using ICT.

Rebound effect
As discussed in section 3.3, rebound effects will have to be addressed when implementing DoICT or DbICT. This dimension classifies if a paper discusses possible rebound or backfire effects. This dimension has one value representing yes/no.

Value	Description
Yes	The paper mentions rebound effects that might occur when implementing ICT or degrowth principles.

4.1.3 Technology focus

The technology focus contains the dimensions that categorise the type and nature of the technologies that are mentioned in a paper. Usually papers will focus on one technology (in this context: a given implementation of ICT), but it can include multiple. These technologies are discussed in relation to degrowth or the implementation thereof. The focus contains four dimensions.

Ownership
This dimension concerns where the ownership of degrowth/ICT technologies lie. This dimension was inspired by the concept of Digital Commons, especially by the work of Kostakis et al. (2018).

Value	Description
Private	The relevant technologies are owned by persons or corporations.
Commons	The relevant technologies are owned by no-one in particular, part of the (digital) commons.

Affected industries
The affected industries are the target of the theories and practices contained in a paper. If the technologies are targeted at a specific industry sector, we use the Statistical Classification of Economic Activities in the European Community (NACE) level 1 sections, as detailed in Regulation (EC) No 1893/2006 (n.d.). If the target is more than one sector, it is classified as generic.

Value	Description
Industry sector	The theories and practices concern an entire industry sector, described by its corresponding NACE level 1 section.
Generic	The theories and practices concern multiple or all industry sectors.

Geographical scope
This dimension looks at the geographical scope of the change, or in other words where

the affected sectors or participating actors are located geographically.

Value	Description
Local	The scope of the paper includes small communities, local organizations or specific towns/cities.
National	The scope of the paper includes (companies that operate in) one country.
International	The scope of the paper includes (companies that operate in) multiple countries.
Global	The scope of the paper includes many different countries across the planet, multinational corporations or NGO's.

Level of Technology
This dimension concerns what level of technology is associated with a paper. This level is judged by the amount of digital technology advocated for in a given paper. Recommending methods or solutions to decrease the use of ICT constitutes a low-tech level, while advocating for more ICT solutions constitutes a high-tech level. This dimension was inspired by conversations with interviewees. The values in this dimension are inclusive.

Value	Description
Low-tech	We define low-tech as any decrease in the use of high-tech (especially ICT) solutions. This includes replacing current high-tech solutions with low-tech solutions (such as replacing grid-powered websites with solar websites, (Abbing, 2021) or merging multiple high-tech solutions into one comparatively smaller solution (such as the digital commons (Kostakis et al., 2018)).
High-Tech	We define high-tech as any increase in the use of high-tech (especially ICT) solutions. This includes hypothetical to-be scenarios or intermediate scenarios.

4.1.4 Contribution focus

The next dimensions concern the contributions of the paper in a more concrete manner. We include these to better categorize the papers, and find points of interest in the overall analysis of the framework. This focus contains four dimensions.

Argumentation
The argumentation of the paper is the structural background provided for the takeaway of the paper. These can be supported by literature or other research in the form of arguments or models.

Value	Description
Narratives	The paper provides textual arguments based or a thought experiment based on scientific literature constructed around a narrative.
(Empirical) models	The paper provides models that support the theory or practice (such as a causal loop diagram) . Possibly based on empirical data
Theory	The paper proposes a theorem by joining multiple accepted truths into a new (not self-evident) truth.

Takeaway
We define the takeaway of the paper as any concrete research artifact or construct that is made by the authors. If other values other than the ones below are encountered they are appended to the framework. A paper can have one or multiple takeaways. The method and tool values and descriptions are modifications of Brinkkemper (1996). We also determine if the paper contributes any best practices for implementing degrowth

principles in ICT, or using ICT to implement degrowth principles.

Value	Description
Method	A method is an approach to perform a project, based on a specific way of thinking, consisting of directions and rules, structured in a systematic way. This value includes method fragments.
Tool	A tool is a possibly automated means to support a part of a process.
Best practices	The paper includes best practices on degrowth and ICT, defined as any recommendation or rule that can be applied when executing a project concerning DoICT or DbICT.

Validation
Papers will contain claims and assumptions. We discern these to see if they are validated by more than literary evidence. This dimension has one value representing yes/no.

Value	Description
Yes	Claims are validated when they are backed by statistical validation, empirical data or experimentation.

Imaginaries
Imaginaries on degrowth and ICT are shared values and norms common to the people included in the scenario which allow them to imagine a corresponding worldview. This dimension has one value representing yes/no. Inspired by March (2018).

Value	Description
Yes	The paper contains one or more imaginaries on degrowth and ICT.

4.1.5 Research focus

Finally, the research focus provides insight into the authors and publications of the papers. The following dimensions are included because they allow for analysis of the metadata of the papers, resulting in the identification of certain trends within this metadata. This focus contains four dimensions

Value	Description
Focus Groups	During the research, at least one focus group was conducted. is a session where participants are asked guiding questions to facilitate a discussion about a certain subject to gauge opinions and themes.
Survey	The paper includes the use of a survey to gauge opinions or other data from a crowd.
Interviews	The paper includes one or more interviews that discuss a topic related to the research.
Literature analysis	The paper is based on an analytical literature analysis or a similar technique such as systematic analysis.
Design analysis	The findings of the paper are based on the detailed analysis of the design of any given product, service or similar object.
Thought experiment	The paper is based on a hypothetical situation that is laid out in full, including preconditions, a step-by-step description and consequences.
Case study	The paper includes the study of one or more practical cases, (which can be previously started, in the process of starting or already finished) that serve to inspire or illustrate the theory in the paper.
Dialogue	The paper is based on a dialogue between two or more people, who discuss a certain subject and document interesting findings, or points of consensus and disagreement.

Value	Description
Technical report	The paper is a technical report, which is written to demonstrate the entirety of a given technical process or project that has been, or is to be undertaken.
Observation	The paper includes observations of people outside the
Data analysis	The paper is (partly) based on the analysis of empirical data, that has been obtained by the authors through experimentation or through other means.
Experiment	The paper includes a practical experiment, distinct from a thought experiment in that it generates empirical data, and takes place in the physical world, either through real-world implementation or computer simulation.

Year of publication
This dimension defines the year in which the paper was published.

Countries of affiliation
This dimension lists the countries of affiliation of each listed author. We define this as the country of the institute that the researcher is affiliated with listed in the publication or on the website of publication.

Number of citations This dimension contains the number of citations of a paper as mentioned in the database of Google Scholar. This dimension does not have predetermined values and is adopted according to the value in the Google Scholar database on 2022-07-04.

Research method
This dimension lists the method(s) used in the paper. A paper can use none, one or multiple of the methods.

5 Attitude Study Results

5.1 Interviews & Focus Groups

In this section, we discuss overlapping themes expressed in the focus groups and interviews. These themes were identified by examining the transcripts for recurring opinions and attitudes towards certain issues. In addition to the analysis above, a number of excerpts representing attitudes were included in the concourse that created the Q-set (see appendix E). We have conducted four focus groups, whose participants were students from the Business Informatics and Human-Computer Interaction master studies at Utrecht University. We conducted six interviews, all with members of the degrowth community.

Use of terminology
The interviewees expressed some shared views on multiple subjects that were raised during the interviews. One such subject was the use of the term 'degrowth' as language that is provocative and hard to subvert. This is relevant to this research, as we explicitly require use of the term for inclusion in the mapping study. Some interviewees expressed doubts about the universal usefulness of the term (I3: "The concept in itself, the branding of the concept is that to say, it may work in some regions of the world, it may not work in other regions of the world, because it is very cultural after all."),

and interviewee 6 agrees that it is a useful critique, "at least in the North." The use of radical terminology (as opposed to gradual) provoked an negative response in the focus groups. In all groups, a majority agreed that radical change is undesirable, because the positive effects that it could have are offset by the amount of resistance it will elicit from society (FGA: "Radical change could attract a lot of opposition, both people and big companies", FGD: "People might be opposed to radical ideas and disagree. On environmental issues it might be necessary, but people will still oppose it. People are scared of radical change."). This majority of participants preferred gradual change, but some disagreement existed (FGB: "One small gradual change does nothing much. But do people accept radical change?").

Green growth and common perceptions on degrowth
Another shared opinion concerns the issues on green growth. Interviewees expressed agreement with the notion that green growth is accepted by society and policymakers as a viable solution to the problems created economic growth. Interviewee 5 summarised that people are clinging onto green growth and rejecting antithetical ideas because "our social software and our political software are not very shaped to be able to embrace, understand and value anything that relates to a contraction, degrowth". This line of thinking can be followed to our continued use of ICT. An illustration comes in the form of 'smart' appliances, or "the trend of putting microchips in everything, which I find very absurd." (I5). As expressed in the focus groups, people feel that ICT should be used as a solution to the problems we face, for instance by using it for increasing efficiency and sustainability. As one participant stated: "Growth of ICT is essential to solving the problems we are facing. Using smart systems to reduce energy consumption, and buying used goods is now easier" (FGC), and that "We should embrace what we have instead of limiting our usage of ICT because there are many ways to use ICT for good." (FGB).

Decreasing use of ICT
Interestingly, participants agreed that limiting our use of ICT is something to strive for (FGC: "when facebook and instagram went down for a day, people rather enjoyed it"), while being hesitant about what this would mean for our ability to utilise ICT for innovation, among other things ("[Think of] Moores law, processors doubling every year. How would this law have developed if we stopped releasing phones every month?]" (FGB). There is also concern about degrowing ICT, as a participant of focus group B expressed "If you degrow ICT, then you limit the possibilities of degrowth by ICT". Doubt was expressed on the possibility of degrowing ICT, in the sense that "it is impossible for many companies to let ICT out of the picture altogether" (FGB). However, agreement existed between focus groups that a good way to degrow ICT would be to offer longer support, and design systems that both lasted longer and prevent overuse (FGB: "We can reduce ICT by supporting older devices as long as possible so consumers are not required to buy new computers.", FGD: "Degrowth can be applied in the sense that you develop ICT that is useful for a person but prevents overuse.").

Dependency on high-tech solutions
In general, the interviewees were negative towards using high-tech (ICT) solutions to implement degrowth principles, but acknowledged that this way of thinking is ingrained in our society. According to interviewee 4, we should "first look at the way we want to live and the kind of society we want to have and then look what sort of minimal appropriate technology is needed to achieve it." Interviewees warned of being caught in a feedback loop of ICT and degrowth. Using ICT as a solution exacerbates the negative effects and externalities of ICT, creating more and more dependence on this technology

(I6: "On the one hand you need to slow down and downscale and on the other side you have to apply more ICT in order to facilitate degrowth"). An important concept here is the principle of 'least appropriate technology'. This principle represents a different way of thinking about technology. Instead of looking for applications for high-tech solutions, you find solutions that use the least amount of technology, or in other words, the most low-tech solution. The focus group were divided on this concern. On one hand, participants were eager to endorse ICT as a facilitator of sustainable change as mentioned above. On the other hand, the warnings of the interviewees were echoed (FGC: "The incremental nature of ICT is a contribution to the problem, generations of products create a continuous feedback loop of consumerism"), even going so far as to denounce the connection between degrowth and ICT (FGA: "Degrowth and ICT do not work well together. ICT does not have well-being in mind."). We interpret this as a shared concern about the current use of ICT in a growth-oriented economic setting, while accepting that ICT can be used as a tool to implement sustainable and more degrowth-oriented principles. In order to make this happen, both focus group participants and interviewees agreed that it is important to focus on the principles of degrowth rather than the term itself (I1: "strategically it is a better idea to market the ideas behind degrowth instead of the term.)".

5.2 Q-Sort

We have conducted 34 Q-sortings using different participants. The statement scores of each sorting were stored and loaded into KADE for analysis. Watts & Stenner (2005) state that during Q-sort analysis, one can use judgmental (or 'by-hand') analysis or use computational techniques to find a mathematically optimal analysis. We have chosen to use the computational analysis using Principal Component Analysis (PCA) and varimax rotation. We use this mathematically optimal analysis to produce a solution that "maximizes the amount of variance explained by the extracted factors" (Watts & Stenner, 2005), and this analysis method produces that maximized solution. Computational analysis results that are reliable and replicable. PCA was used to extract 8 factors from the raw sortings. We use varimax rotation, and auto-flag the participants for loading onto the factors with a significance threshold of $p<0.05$. Loading a participant onto a factor means that the given sort is statistically close enough to the average sort that the factor represents.
We keep the factor loadings that have an eigenvalue of higher than 1.00 and at least two significantly loading participants (Watts & Stenner, 2005). This results in 6 distinct factors. Each factor has a number of defining statements, meaning that all participants gave that statement the same or a very similar score. These defining statements were automatically flagged by KADE with a significance threshold of $p<0.05$. Lastly, we find the 'consensus statement'. This is any statements that have a similar average score across all factors. See Table 4 for the participants loaded onto each factor. Unloaded participants have no significant correlation with any factor.

Table 3: Q-Sort statements and covered topics

ID	**Statement**	**Topic(s)**
1	We should measure ecological and happiness factors as an indication of progress, instead of economic growth	GDP, degrowth
2	Capitalism is the least evil economic system we can have, and we should maintain it	Capitalism
3	The economy should be left alone, and interfering will worsen current environmental and societal problems	Capitalism

ID	Statement	Topic(s)
4	Economic growth is necessary to maintain our standards of living	Growth
5	Economic growth has to be decoupled from ecological impact by implementing sustainable business practices	Green growth
6	We should prepare for how the world will look if the economy stops growing	Degrowth, post-growth
7	Any policy that will increase sustainability but negatively affects the economy is hard to sell	Policy, terminology
8	Not all sectors should shrink to reduce their environmental impact; examples are healthcare or education	Growth
9	Countries with smaller economies should be allowed to keep growing	Climate justice
10	Reducing the amount of ICT we use will decrease the positive impacts that we can achieve with ICT	ICT innovation
11	The amount of ICT we use in our daily lives should be reduced	Degrowth of ICT
12	The efficiency gains provided by ICT should be used to decrease the ecological impact of industries	Degrowth by ICT
13	We should keep using ICT to improve efficiency in other industry sectors	Degrowth by ICT
14	"Smart" appliances that connect to the internet can help us become more sustainable consumers	ICT innovation, sustainability
15	ICT use is disconnecting us from each other and the world we live in	Alienation
16	ICT should be designed for people, not for corporations	Conviviality
17	It is important to recognise the limits of the planet and keep consumption within those limits	Planetary boundaries
18	Governments and corporations should take immediate and drastic action to fix environmental issues	Climate action
19	Global consumption of natural resources and demand for products should be reduced	Degrowth
20	It is important that countries with a larger economy contribute more to solving climate change than developing countries	Climate justice
21	Countries should focus on being self-sustaining in regards to energy and food production	Climate justice
22	We should prioritise reducing energy usage over switching to clean energy	Clean energy
23	Economic growth is necessary for innovation	Growth
24	ICT is required for innovation	ICT innovation
25	Gradual change works better than radical change, as gradual changes are more easily accepted by society	Policy, terminology
26	Terms that are controversial or designed to provoke, work better than more friendly terms when making change	Policy, terminology
27	Almost all innovations that happen nowadays are in the ICT sector, or heavily rely on ICT	ICT innovation
28	We have to invest in innovations that will help us clean the environment	Green growth
29	Current innovations are having less and less impact on our daily lives than in the 20th century	Post-growth

ID	Statement	Topic(s)
30	We have to use technological innovations to stop exploiting nature, and still be able to grow the economy	Green growth
31	It is difficult to think of alternatives to our current economic system	Post-growth imaginaries
32	We can live with less, but still be happy	Frugal Abundance
33	Renting or leasing expensive things is more convenient than buying them	Things as a service

Table 4: Participant loadings and eigenvalues per factor

Factor	Eigenvalue	Loaded participants
Factor 1	11.24	1, 19, 20, 21, 22, 25, 26, 30
Factor 2	4.05	10, 13, 34
Factor 3	2.45	2, 11, 16, 23, 27, 28, 29
Factor 4	1.95	3, 15, 18
Factor 5	1.75	6, 14
Factor 6	1.54	17, 33
Unloaded	N.A.	5, 8, 7, 9, 12

5.2.1 Factor analysis

In this section, we analyze each factor individually. For this analysis we look at the statement scores in relation to each other to find general opinions and attitudes. Scores that are very positive or negative are very interesting in this regard, but we also consider the statements that have a more neutral scores. We designate each factor with a title that represents their main interests. We include a factor visualization of the composite (statistically average) Q-sort per factor. Each factor is also additionally visualized in appendix F. This visualization represents topics that this factor finds important through graphical icons.

Factor 1: *Environmentalist*
Factor 1 has 9 significant loading participants. The eigenvalue of this factor is 11.24, and it explains 21% of the variance.

According to the opinion of this factor, drastic environmental action is needed to respect planetary boundaries and reduce production and consumption of natural resources, (18, 19: +3, 17, 28, 32: +2). Technological innovation should be used to achieve this impact (28: +2, 30: +1, 29: -3) (participant 20 does mention that "you can use ICT for good but it probably won't be."), and countries with larger economies should contribute more to this cause (20: +2, 9: +1). The *Environmentalist* is opposed to economic growth and capitalism (3, 4: -3, 2: -2), disagrees that these are necessary for innovation (23: -2) and feels that we should use different metrics to indicate societal progress (1: +3). Accordingly, we can achieve more positive impact with less ICT ("ICT should always be supporting, never leading": Participant 21), and ICT is not necessarily required for innovation (10: -1, 24: -1). However, this factor does not strongly feel that we should reduce the amount of ICT we use in our daily lives (11: -1). Participant 19 notes "ICT is a very broad subject [and] it could be used in both good and bad ways." The *Environmentalist* does not think it is difficult to think of alternatives to capitalism (31:

-2) (Participant 22 comments: "I don't think I ever thought about a possibility of a different economic system. But I think we could definitely do better"), and agrees that we should prepare for when the economy stops growing (6: +1). Radical change is not out of the question (25, -1, 7: 1), but the usefulness of radical terminology is doubted (26: -1).

-3	-2	-1	0	1	2	3
29. Current innovations are having less and less impact on our daily lives	27. Almost all innovations that happen nowadays are in the ICT sector,	24. ICT is required for innovation	12. The efficiency gains provided by ICT should be used to	21. Countries should focus on being self-sustaining in regards to	32. We can live with less, but still be happy	18. Governments and corporations should take immediate and
4. Economic growth is necessary to maintain our standards of	23. Economic growth is necessary for innovation	25. Gradual change works better than radical change, as gradual	22. We should prioritise reducing energy usage over switching to	6. We should prepare for how the world will look if the economy stops	17. It is important to recognise the limits of the planet and keep	1. We should measure ecological and happiness factors as an
3. The economy should be left alone, and interfering will worsen	31. It is difficult to think of alternatives to our current	26. Terms that are controversial or designed to provoke, work	8. Not all sectors should shrink to reduce their environmental	30. We have to use technological innovations to stop exploiting	28. We have to invest in innovations that will help us clean the	19. Global consumption of natural resources and demand for
	2. Capitalism is the least evil economic system we can have, and we	16. ICT should be designed for people, not for corporations	33. Renting or leasing expensive things is more convenient than	9. Countries with smaller economies should be allowed to keep	20. It is important that countries with a larger economy	
		11. The amount of ICT we use in our daily lives should be reduced	14. "Smart" appliances that connect to the internet, such as thermostats	15. ICT use is disconnecting us from each other and the world we live		
		10. Reducing the amount of ICT we use will decrease the positive	5. Economic growth has to be decoupled from ecological impact by	7. Any policy that will increase sustainability but negatively		
			13. We should keep using ICT to improve efficiency in other industry			

Figure 10: Composite Q-sort of factor 1.

Factor 2: *Techno-futurist*
Factor 2 has 3 significant loading participants. The eigenvalue of this factor is 4.05, and it explains 8% of the variance.

The *Techno-futurist* feels we should use technological innovation to become more sustainable and reduce our environmental impact (14, 30: +3, 12, 13: +2). However, planetary limits and reduction of consumption are less important (17, 19: -1). Consumers should become more sustainable using smart appliances (14: +2), disagreeing that governments and corporations should take drastic climate action (18: -2). Countries should also become self-sustainable (21: +1). Factor 3 disagrees that innovation mostly happens in the ICT sector (27: -3), while agreeing that innovation requires ICT (24: +1) and that we should not reduce ICT use in our daily life (11: -2). This factor feels that economic growth is important, especially to maintain our standards of living (4, 30: +3, 7: +1) but not necessarily for innovation (23: 0). The *Techno-futurist* finds that while it is not difficult to think of alternative economic systems (31: -2), we do not have to prepare for when growth stops (6: -3). Is very opposed towards controversial or provocational terminology (26: -3), but disinclined towards radical change (25: -2).

-3	-2	-1	0	1	2	3
27. Almost all innovations that happen nowadays are in the ICT sector,	18. Governments and corporations should take immediate and	15. ICT use is disconnecting us from each other and the world we live	28. We have to invest in innovations that will help us clean the	21. Countries should focus on being self-sustaining in regards to	14. "Smart" appliances that connect to the internet, such as thermostats	30. We have to use technological innovations to stop exploiting
26. Terms that are controversial or designed to provoke, work	25. Gradual change works better than radical change, as gradual	19. Global consumption of natural resources and demand for	20. It is important that countries with a larger economy	1. We should measure ecological and happiness factors as an	32. We can live with less, but still be happy	8. Not all sectors should shrink to reduce their environmental
6. We should prepare for how the world will look if the economy stops	31. It is difficult to think of alternatives to our current	22. We should prioritise reducing energy usage over switching to	33. Renting or leasing expensive things is more convenient than	7. Any policy that will increase sustainability but negatively	13. We should keep using ICT to improve efficiency in other industry	4. Economic growth is necessary to maintain our standards of
	11. The amount of ICT we use in our daily lives should be reduced	2. Capitalism is the least evil economic system we can have, and we	16. ICT should be designed for people, not for corporations	3. The economy should be left alone, and interfering will worsen	12. The efficiency gains provided by ICT should be used to	
		5. Economic growth has to be decoupled from ecological impact by	10. Reducing the amount of ICT we use will decrease the positive	9. Countries with smaller economies should be allowed to keep		
		17. It is important to recognise the limits of the planet and keep	23. Economic growth is necessary for innovation	24. ICT is required for innovation		
			29. Current innovations are having less and less impact on our daily lives			

Figure 11: Composite Q-sort of factor 2.

Factor 3: *Eco-futurist*
Factor 3 has 8 significant loading participants. The eigenvalue of this factor is 2.45, and it explains 14% of the variance.

The *Eco-futurist* strongly feels we should not reduce ICT use in our daily life (11: -3), as participant 28 comments: "It was hard to disagree [with statement 11] because I think it might be nice but it is just not possible." Factor 2 feels we should focus on improving efficiency across industries using more clean-energy powered ICT (13: +3 22: -2). Participant 11 comments that "Increased efficiency doesn't only help corporations reach their KPIs, but also employees by increasing their productivity and reducing their stress." This factor agrees that ICT is required for innovation (24: +2), but feels neutral on whether innovations rely on ICT (27: 0). Thinks ICT should (also) be designed for corporations (16: -1), and completely disagrees that it is disconnecting us from the natural world (15: -3). Thinks technology is important to reduce ecological impact (28: +2, 14, 30: +1), and that governments and corporations should take action (18: +3) to reduce our consumption and production to within planetary limits (17: +3, 19: +1). Participant 23 notes that "it is easy to care about that", and participant 2 agrees that "everyone needs to be aware of its [the environments] importance". The *Eco-futurist* is quite indifferent towards economic growth (23: 0, 4: -1), and neutral on policy and terminology-oriented statements (7, 25, 26: 0). This factor has difficulty thinking of alternatives to our current economy (31: +2), while feeling that there is no rush to prepare for when it stops growing (6: -2).

-3	-2	-1	0	1	2	3
15. ICT use is disconnecting us from each other and the world we live	21. Countries should focus on being self-sustaining in regards to	4. Economic growth is necessary to maintain our standards of	25. Gradual change works better than radical change, as gradual	14. "Smart" appliances that connect to the internet, such as thermostats	24. ICT is required for innovation	17. It is important to recognise the limits of the planet and keep
3. The economy should be left alone, and interfering will worsen	29. Current innovations are having less and less impact on our daily lives	2. Capitalism is the least evil economic system we can have, and we	7. Any policy that will increase sustainability but negatively	19. Global consumption of natural resources and demand for	28. We have to invest in innovations that will help us clean the	13. We should keep using ICT to improve efficiency in other industry
11. The amount of ICT we use in our daily lives should be reduced	6. We should prepare for how the world will look if the economy stops	10. Reducing the amount of ICT we use will decrease the positive	26. Terms that are controversial or designed to provoke, work	12. The efficiency gains provided by ICT should be used to	32. We can live with less, but still be happy	18. Governments and corporations should take immediate and
	22. We should prioritise reducing energy usage over switching to	1. We should measure ecological and happiness factors as an	8. Not all sectors should shrink to reduce their environmental	30. We have to use technological innovations to stop exploiting	31. It is difficult to think of alternatives to our current	
		16. ICT should be designed for people, not for corporations	23. Economic growth is necessary for innovation	5. Economic growth has to be decoupled from ecological impact by		
		33. Renting or leasing expensive things is more convenient than	20. It is important that countries with a larger economy	9. Countries with smaller economies should be allowed to keep		
			27. Almost all innovations that happen nowadays are in the ICT sector,			

Figure 12: Composite Q-sort of factor 3.

Factor 4: *ICT advocate*
Factor 4 has 3 significant loading participants. The eigenvalue of this factor is 1.95, and it explains 9% of the variance.

The *ICT advocate* feels strongly that we should not use less ICT, and thinks it is not disconnecting us from the rest of the world (11, 15: -3), and feels that less ICT use will have less positive impact (10: +1). Tempering this, participant 3 comments "There are other important things as well [besides ICT]". Factor 4 agrees with recognising planetary limits and reducing consumption (17: +2, 19: +1), ("It was easy to be positive about the environment": participant 19 comment). Emphasis should be placed on using technology, innovation and clean energy to reduce our impact on the climate (28: +3, 13, 22: -2), but is doubtful towards the effectiveness of smart appliances towards this goal (14: -1). Factor 3 thinks governments or corporations should not have to take drastic action to fix environmental issues (18, -3), however participant 16 notes that "Saying things about government policy is difficult". The *ICT advocate* is convinced that gradual change and friendly terminology is important (25: +3, 26: -2). Economic growth is of no concern to this factor (3, 5, 7, 30: 0), because it is unimportant for innovation or our standards of living (23: -2, 4: -1). While being inclined towards our current economic system (2: +1), feels we should prepare for when the economy stops growing (6: +2), but has moderate difficulty thinking of alternatives (31: +1).

-3	-2	-1	0	1	2	3
18. Governments and corporations should take immediate and	23. Economic growth is necessary for innovation	4. Economic growth is necessary to maintain our standards of	20. It is important that countries with a larger economy	31. It is difficult to think of alternatives to our current	1. We should measure ecological and happiness factors as an	32. We can live with less, but still be happy
11. The amount of ICT we use in our daily lives should be reduced	22. We should prioritise reducing energy usage over switching to	14. "Smart" appliances that connect to the internet, such as thermostats	7. Any policy that will increase sustainability but negatively	19. Global consumption of natural resources and demand for	6. We should prepare for how the world will look if the economy stops	25. Gradual change works better than radical change, as gradual
15. ICT use is disconnecting us from each other and the world we live	33. Renting or leasing expensive things is more convenient than	29. Current innovations are having less and less impact on our daily lives	3. The economy should be left alone, and interfering will worsen	27. Almost all innovations that happen nowadays are in the ICT sector,	13. We should keep using ICT to improve efficiency in other industry	28. We have to invest in innovations that will help us clean the
	26. Terms that are controversial or designed to provoke, work	21. Countries should focus on being self-sustaining in regards to	12. The efficiency gains provided by ICT should be used to	9. Countries with smaller economies should be allowed to keep	17. It is important to recognise the limits of the planet and keep	
		24. ICT is required for innovation	5. Economic growth has to be decoupled from ecological impact by	10. Reducing the amount of ICT we use will decrease the positive		
		8. Not all sectors should shrink to reduce their environmental	16. ICT should be designed for people, not for corporations	2. Capitalism is the least evil economic system we can have, and we		
			30. We have to use technological innovations to stop exploiting			

Figure 13: Composite Q-sort of factor 4.

Factor 5: *Business-as-usualist*
Factor 5 has 2 significant loading participants. The eigenvalue of this factor is 1.75, and it explains 7% of the variance.

The *Business-as-usualist* is opposed to statements that contradict the current status quo of (western) society. This is evident in the opinions that current innovations still impact our lives (29: -3), buying expensive things is convenient (33: -3), continuation of the use of economic growth as metric for progress (1: -3), and that not all sectors should shrink to reduce their environmental impact (8: +3). We should not hasten to prepare for when the economy stops growing (6: -1). Factor 5 is inclined towards gradual change and terminology (25: +2, 26: -1), and is neutral towards the difficulty of thinking of alternatives to capitalism (31: +1), while disagreeing with the fact that it is the least evil and there is no alternative (2: -2). The *Business-as-usualist* feels that we should use technological innovation to clean the environment (28, +3), and that countries with large economies should pay to enact these solutions (20: +3). Is inclined towards the use of ICT (11: -1), agrees that current innovation almost always involves ICT (27: +2), and that ICT is required for innovation (24: +1), and corporations (16: -2). However, feels indifferent about smart systems for sustainability (14: 0). Subsequently, is not convinced that we should reduce our daily ICT use (11: -1), and that it should be designed for corporations as well as people (16: -2).

-3	-2	-1	0	1	2	3
1. We should measure ecological and happiness factors as an	3. The economy should be left alone, and interfering will worsen	11. The amount of ICT we use in our daily lives should be reduced	31. It is difficult to think of alternatives to our current	18. Governments and corporations should take immediate and	27. Almost all innovations that happen nowadays are in the ICT sector,	8. Not all sectors should shrink to reduce their environmental
29. Current innovations are having less and less impact on our daily lives	2. Capitalism is the least evil economic system we can have, and we	10. Reducing the amount of ICT we use will decrease the positive	15. ICT use is disconnecting us from each other and the world we live	17. It is important to recognise the limits of the planet and keep	32. We can live with less, but still be happy	28. We have to invest in innovations that will help us clean the
33. Renting or leasing expensive things is more convenient than	16. ICT should be designed for people, not for corporations	12. The efficiency gains provided by ICT should be used to	13. We should keep using ICT to improve efficiency in other industry	19. Global consumption of natural resources and demand for	25. Gradual change works better than radical change, as gradual	20. It is important that countries with a larger economy
	4. Economic growth is necessary to maintain our standards of	6. We should prepare for how the world will look if the economy stops	21. Countries should focus on being self-sustaining in regards to	24. ICT is required for innovation	9. Countries with smaller economies should be allowed to keep	
		26. Terms that are controversial or designed to provoke, work	14. "Smart" appliances that connect to the internet, such as thermostats	22. We should prioritise reducing energy usage over switching to		
		30. We have to use technological innovations to stop exploiting	5. Economic growth has to be decoupled from ecological impact by	23. Economic growth is necessary for innovation		
			7. Any policy that will increase sustainability but negatively			

Figure 14: Composite Q-sort of factor 5.

Factor 6: *Green growther*
Factor 6 has 2 significant loading participants. The eigenvalue of this factor is 1.54, and it explains 8% of the variance.

The *Green growther* is strongly convinced that we have to use technological innovation to ensure a clean environment while maintaining economic growth (28, 30: +3) and is neutral towards using different factors to measure progress (1: 0). The burden of this should rest more on consumers (14: +2) than on governments and corporations (18: +1). Is disinclined towards reducing global consumption and demand (19: -1). This factor is heavily inclined toward gradual change that keeps economic growth in mind (25: +3, 7: +2, 26: -1), and feels that countries should not focus on being self-sufficient (21: -3). However, does not feel that interfering in the economy will worsen current problems (3: -3). Factor 6 is also the only factor not to agree with the statement "we can live with less, but still be happy" (32: 0). Regarding ICT, this factor feels we should use ICT to make industries both more efficient and more sustainable (12, 13: +1). ICT is required for innovation (24: +1), and should be designed for corporations (23: -2). Is neutral towards reducing daily ICT use (11: 0) and neutral regarding the reliance of current innovations on ICT (10: 0). The *Green growther* has no difficulty thinking of alternatives to capitalism (31: -3), but is convinced that we should maintain the current capitalist system (2: +2).

-3	-2	-1	0	1	2	3
31. It is difficult to think of alternatives to our current	9. Countries with smaller economies should be allowed to keep	19. Global consumption of natural resources and demand for	22. We should prioritise reducing energy usage over switching to	24. ICT is required for innovation	7. Any policy that will increase sustainability but negatively	25. Gradual change works better than radical change, as gradual
3. The economy should be left alone, and interfering will worsen	23. Economic growth is necessary for innovation	33. Renting or leasing expensive things is more convenient than	8. Not all sectors should shrink to reduce their environmental	29. Current innovations are having less and less impact on our daily lives	20. It is important that countries with a larger economy	30. We have to use technological innovations to stop exploiting
21. Countries should focus on being self-sustaining in regards to	4. Economic growth is necessary to maintain our standards of	5. Economic growth has to be decoupled from ecological impact by	10. Reducing the amount of ICT we use will decrease the positive	13. We should keep using ICT to improve efficiency in other industry	2. Capitalism is the least evil economic system we can have, and we	28. We have to invest in innovations that will help us clean the
	16. ICT should be designed for people, not for corporations	6. We should prepare for how the world will look if the economy stops	11. The amount of ICT we use in our daily lives should be reduced	18. Governments and corporations should take immediate and	14. "Smart" appliances that connect to the internet, such as thermostats	
		26. Terms that are controversial or designed to provoke, work	32. We can live with less, but still be happy	17. It is important to recognise the limits of the planet and keep		
		15. ICT use is disconnecting us from each other and the world we live	27. Almost all innovations that happen nowadays are in the ICT sector,	12. The efficiency gains provided by ICT should be used to		
			1. We should measure ecological and happiness factors as an			

Figure 15: Composite Q-sort of factor 6.

5.2.2 Statement analysis

In this subsection, the statements are analyzed individually. For this analysis, we look at how the statements have been sorted by each factor and the relation between those scores. Statements that have either a high agreement rate ('consensus') or a low agreement rate ('disagreement') between the factors are interesting for this analysis. Consensus means that all factors have (almost) the same opinion, i.e. similar scores, about a certain statement, either agree, disagree, or neutral. When there is a disagreement, it means that (almost) all of the factors have a different opinion, i.e. different scores, about a certain statement. We also list the z-score variance for each statement which is an indication of the amount of (dis)agreement. A lower variance means that the scores for a statement (between factors) are relatively close together, while a high variance means that the scores are further apart.
We also analyze the scores of each factor for the statements concerning degrowth and ICT, because they can be linked to the conceptual framework described in section 3. Finally, the results of the Reddit survey with closed questions are compared with the analysis of the individual statements for those statements that were used in both the survey and the Q-sort.

Consensus

There are a few statements on which all factors agree or are neutral. Statement 28 is one such statement (scores: +2, 0, +2, +3, +3, +3, z-score variance 0.25). This

indicates that all factors are very positive towards technology that will help us clean the environment, with the exception of factor 2 which is neutral. This indicates broad support for the theory that enough technological innovations will allow us to fix climate change, a theory which is central to the notion of green growth.
Statement 5 is the statement with the highest amount of consensus. Notably, this statement is very mixed in scores, indicating that while the factor scores are close together, the individual opinion on these statements differ. For instance, while factors 1, 4, and 5 are neutral on decoupling economic growth from environmental impact through technological innovation, factor 3 agrees that this decoupling should happen, and factors 2 and 6 disagree that we should decouple these two things through innovation. The same difference in opinions is expressed in statement 10 and 12, which are the other two statements with the lowest z-score variance (0.192 and 0.221 respectively). We can conclude that these statements elicit different opinions from these factors, but these opinions are not extremely important to any one factor.
Another statement that the factors agreed on was statement 26, with scores of -1, -3, 0, -2, -1, -1 (z-score variance 0.223). This indicates that all factors (with the exception of the eco-futurist), are disinclined towards the use of radical and controversial terminology, and that they most likely feel that more gradual and friendly terminology will be more accepted. We can also combine this with the scores for statement 25 (-1, -2, 0, +3, +2, +3, z-score variance 1.331) which indicate more division between the different factors. The eco-futurist is neutral on whether gradual change works better in society, but while the environmentalist and techno-futurist are more inclined towards radical change, the rest of the factors (ICT advocate, business-as-usualist, green growther) feel strongly that gradual change works much better because of easier acceptance by society.
The final statement that we examine here, is statement 32. The scores of factors 1 to 6 were +2, +2, +2, +3, +2, 0, respectively, resulting in a variance of the z-scores of 0,49. This means that there is a relatively low degree of spread between the factors and that they all think that we can live with less, but still be happy with the notable exception of the green growther. This supports the opinions expressed in the Reddit survey and interviews, alongside the literature surrounding this concept of frugal abundance which is at the core of the principles of degrowth. This also supports opinions from the interviews that while the term degrowth can be controversial, there is a large amount of support for the principles this term embodies if they are explained.

Disagreement

Statement 1 is the statement on which the factors disagree the most. This can be seen in the scores of the factors, which were +3, +1, -1, +2, -3, and 0 resulting in a variance of the z-scores of 1.281. This means that the participants are very divided on whether we should measure ecological and happiness factors as an indication of progress, instead of economic growth. Interestingly, the results of the Reddit survey show that a large majority (87.%) thinks we should use other ways to measure progress, wealth, and well-being besides the gross domestic product (GDP). This could be explained by a bias within the respondent group of the Reddit survey, as certain subreddits interacted more with the posts in appendix D than others.
Another statement on which the factors disagree strongly is statement 18. The scores of the factors show this, which were +3, -2, +3, -3, +1, and +1 resulting in a variance of the z-scores of 1.468. This means that some factors, namely the environmentalist and eco-futurist, clearly think that governments and corporations should take immediate and drastic action to fix environmental issues, and while the business-as-usualist and green growther mildly agree, two factors strongly disagree, being the techno-futurist and ICT advocate. Clearly, the opinions are very divided, and there is no factor with a neutral

score. These attitudes are reflected in the concourse. This division is an illustration of the notion that consumers bear a personal responsibility to fix climate change, while governments and corporations should support people in taking this responsibility. This notion is opposed to those that attribute unsustainable governmental and corporate policy for facilitating the unsustainable behavior of consumers. In other words, whether climate action should come from a bottom-up or top-down perspective respectively.
The final statement on which the factors are relatively discordant is statement 27. The scores of each factor were -2, -3, 0, +1, +2, and 0 resulting in a variance of the z-scores of each factor of 0.846. This indicates that the factors differ in opinion on whether almost all innovations that happen nowadays are in the ICT sector, or heavily rely on ICT. Comparing this to the rest of the attitude study, we see there is a high amount of agreement that innovation relies on ICT. Interestingly, when we look at statement 24 ('ICT is required for innovation') the scores are -1, +1, +2, -1, +1, and +1 respectively (z-score variance of 0.513). This indicates that the eco-futurist, techno-futurist and green growther feel that while current innovation does occur outside of ICT, ICT is required for the process of innovation. The ICT advocate on the other hand, while agreeing that current innovations rely on ICT, feels it is not a required step in the innovation process. Wherever the factors feel innovation occurs, the results of statement 29 (-3, 0, -2, -1, -3, and -1, z-score variance: 0.529) imply that they all feel this innovation still has a large impact on their daily lives. This is especially notable for the factors 2, 3 and 6, as they think that these impacting innovations are mostly ICT-based.

Degrowth and ICT-related statements

From the scores of statement 11 (-1, -2, -3, -3, -1, and 0, z-score variance of 0.497), it can be derived that each factor disagrees that we should reduce the amount of ICT we use in our daily lives, with the notable exception of the green growther. The only difference is the strength of their opinions. The techno-futurist, eco-futurist, and ICT advocate strongly disagree with reducing the amount of ICT in our daily lives. The environmentalist, and the business-as-usualist share this opinion, but to a lesser extent. Their opinions on this statement can be linked to several dimensions of the conceptual framework, the most prominent option being relational direction, since the factors think that degrowth of ICT in their daily lives should not be realized.
We can also relate this to the conceptual dimension type(s) of degrowth, especially when we take the scores of statement 32 (+2, +2, +2, +3, +2, and 0 z-score variance of 0.49) and statement 19 (+3, -1, +1, +1, +1, and -1, z-score variance of 0.453) into consideration as well. It is clear that those factors think we can live with less, and that the global consumption of natural resources and demand for products should be reduced. So they agree on having some type of degrowth, as long as it will not affect the amount of ICT in their daily lives. Now the scores of statement 11 can also be linked to the dimension level of technology, which encapsulates the amount of digital technology that would be justified. Clearly, the factors agree that the current amount of digital technology is justified and should not be decreased.
Another statement that has a relatively low variance between the z-scores of each factor compared to the other statements, is statement 16. The scores were -1, 0, -1, 0, -2, and -2, respectively, resulting in a variance of the z-scores of 0.291. This means that there is a relatively low degree of spread between the factors and that most factors (except factors 2 and 4) disagree that ICT should be designed for people instead of corporations. As the concept of conviviality is at the core of degrowth principles these attitudes express a disagreement between how ICT should function according to degrowth principles, and how the Q-sort participants feel it should be used. This disagreement also underscores a distinction between the Q-sort participants and attitudes expressed in the

interviews, Reddit survey and literature that support the notion of conviviality. This is also connected to the general agreement on statement 13 ('We should keep using ICT to improve efficiency in other industry sectors'), with scores 0, +2, +3, +2, 0, and +1 (z-score variance 0.411). Implementing efficiency improvements through ICT is supported by factors 2, 3, 4, and 6 while factors 1 and 5 are neutral. Only factors 2 and 4 are neutral on not designing ICT for corporations while the rest disagree, indicating support for corporate ICT. These opinions can be linked to the dimension relational direction because they are definitely not opposed to degrowth by ICT. The factors think that continuing to utilize ICT in improving efficiency in other industry sectors, we can do the same or even more, with fewer resources. The opinions on statement 13 are also related to the dimension level of technology, because it concerns the amount of digital technology we use, and think is justified. It is evident that the factors agree on using more digital technology to improve efficiency in other industry sectors. There is also the question of how this ICT should be powered. As the scores of statement 22 (0, -1, -2, -2, +1, and 0, z-score variance: 0.394) illustrate, factors that agree with statement 13 are, in the case of the techno-futurist, eco-futurist and ICT advocate, very much opposed to reducing energy usage over switching to clean energy. The environmentalist and green growther are neutral on this topic, while the business-as-usualist has a slight preference for the reduction in energy usage over the transition to clean energy.

The scores of statement 15 (+1, -1, -3, -3, 0, and -1, z-score variance of 0.541) show that most factors (except the environmentalist) do not think that ICT use is disconnecting us from each other and the world we live in. This is in line with their opinions of the previous two statements, which were in favor of the amount of ICT in our daily lives and corporate ICT. Together with the opinions of the factors on statements 11 and 13, this is yet another indication that the factors are opposed to the degrowth of ICT, at least when their daily lives are concerned. This is opposed to the opinions expressed in the Reddit survey, where the majority (62%) thinks the amount of ICT we use in our daily lives should be reduced, and only a very small group (14%) thinks the role and amount of ICT in our daily lives is appropriate and should keep developing as it currently is.
On the other hand, the factors (except the business-as-usualist) are slightly positive or neutral about the ideas of degrowth by ICT, the other perspective within the relational direction dimension. The opinions about statement 13 already indicated this, and the scores of statement 12 (0, +2, +1, 0, -1, and +1, z-score variance of 0.221) confirm this. Both the techno-futurist and eco-futurist agree that the efficiency gains provided by ICT should be used to decrease the ecological impact of industries, while the business-as-usualist clearly thinks the opposite.
Lastly, statement 31 is of interest because of opinions expressed in the interviews. The interviewees were in consensus concerning the difficulty of imagining alternatives to our current (capitalist) reality and the importance of imaginaries. However, when looking at the scores for statement 31 (-2, -2, +2, +1, 0 and -3, z-score variance 1.036), we can see that there is disagreement on this between factors. Factors 1 (environmentalist), 2 (techno-futurist) and 6 (green growther) disagreed strongly with the difficulty of imagining alternative economic systems and thus do not find it difficult. Factors 3 (eco-futurist), 4 (ICT advocate) and 5 (business-as-usualist) have more difficulty imagining alternatives to capitalism, however. Many factors choose to embrace growth through technology, meaning that while they can think of alternatives to capitalism, they choose to align their perspective of the future with growth-oriented imaginaries. This difference in conclusions between the interviewees and Q-sort participants points to a different understanding of the difficulties of imagining (or perhaps designing) an alternative economic system.

Table 5 gives an overview of framework dimensions and values that the authors interpret to be closely associated with the different Q-sort factors. We include dimensions that would make factors like or dislike papers that include specific values. Dimensions are indicated in **bold**, positive associations are marked with a plus sign (+), and negative associations are marked with a minus sign (-).

Table 5: Framework dimensions associated with Q-sort factors

ID	Factor title	Framework dimensions
1	Environmentalist	**Relational focus**, DbICT(+). **Types of degrowth**, All values(+). **Green growth**, Positive(-). **Ownership**, Commons(+). **Level of technology**, High-tech(+).
2	Techno-futurist	**Green Growth**, Positive(+). **Types of degrowth**, GDP(-), Agrowth(-). **Type of change**, Radical(-). **Level of technology**, Low-tech(-).
3	Eco-futurist	**Relational focus**, DoICT(-). **Types of degrowth**, Consumption(+), Radical(+), Physical(+). **Conviviality**, Positive(-). **Imaginaries**(+).
4	ICT advocate	**Relational focus**, DoICT(-). **Type of change**, Gradual(+). **Level of technology**, High-tech(+).
5	Business-as-usualist	**Types of degrowth**, Radical(-). **Type of change**, Radical(-). **Change initiator**, Top-down(+).
6	Green growther	**Green Growth**, Positive(+). **Conviviality**, Positive(-). **Types of degrowth**, All values(-). **Type of change**, Gradual(+).

6 Mapping Study

In this section, the results of the mapping study are analyzed. The study was conducted in the method described in section 2.3. The individual mappings and classification scheme can be found in appendix G. The initial set of publications, constructed using the literature search protocol in Appendix A, consists of 105 papers as seen in the second column of Table 7, Appendix A. However, in this set of publications, duplicates were still included. After filtering out the duplicates, 39 papers remained, as can be seen in the third column of table 9. During the mapping study, another 8 papers were found to be unsuitable because they either did not mention degrowth, were not available for reading, did not include ICT or relatable terms, or were duplicates. This results in a total of 31 papers that have been classified, as can be seen in the fourth column of Table 7, A. The overall results of the mapping study, of which an overview can be found in Table 6, consists of counting the values of each dimension included in all of the papers. A graphical overview of these results can be found in Appendix H. Below, a more in-depth analysis of each focus can be found. In these focuses, we analyze values that are either very common or very uncommon, alongside other relevant findings across the classified publication. Furthermore, we look at the dimensions that have been linked to a number of statements in the analysis of the Q-sort (as shown in section 5.2).

Table 6: Results of the mapping study per dimension

Focus	**Dimension**	**Values**	**Results**	
			Studies	**Percentage** (%)
Degrowth	Relational focus	DoICT	19	61.29
		DbICT	16	51.61
	Types of degrowth	GDP	5	16.13
		Consumption	20	64.52
		Work-Time	1	3.23
		Radical	20	64.52
		Physical	17	54.84
		Agrowth	5	16.13
	Valence	+	29	93.55
		-	2	6.45
	Green growth valence	+	6	19.35
		-	21	67.74
	Conviviality valence	+	20	64.52
		-	0	0
Change	Type of Change	Gradual	19	61.29
		Radical	13	41.94
	Scope of change	Intrapersonal	3	9.68
		Interpersonal	5	16.13
		Institutional	6	19.35
		Systemic	24	77.42
		Cultural	14	45.16
	Transition	As-Is	29	93.55
		To-Be	29	93.55
		Intermediates	13	41.94
	Change initiator	Bottom-up	20	64.52
		Top-down	14	45.16
	Side effects		14	45.16
	Rebound Effects		16	51.61

Focus	Dimension	Values	Results	
			Studies	Percentage (%)
Technology	Level of Technology	High-tech	27	87.1
		Low-tech	11	35.48
	Ownership	Commons	15	48.39
		Private	8	25.81
	Affected Industries	NACE: A	1	3.23
		NACE: J	16	51.61
		NACE: K	1	3.23
		NACE: P	1	3.23
		NACE: U	1	3.23
		Generic	11	35.48
	Geographical Scope	Local	12	38.71
		National	4	12.9
		International	5	16.13
		Global	18	58.06
Contribution	Argumentation	Narrative	30	96.77
		Models	4	12.9
		Theory	3	9.68
	Takeaway	Method	11	35.48
		Tool	2	6.45
		Best practices	15	48.39
	Testing	Validation	4	12.9
	Imaginaries		23	74.19
Research	Research Method	Survey	3	9.68
		Interviews	2	6.45
		Focus group	0	0
		Design analysis	1	3.23
		Literature analysis	22	70.97
		Thought exp.	1	3.23
		Case study	6	19.35
		Dialogue	1	3.23
		Technical Report	1	3.23
		Observation	2	6.45
		Data analysis	1	3.23
		Experiment	1	3.23
	Publication Year	2014	3	9.68
		2016	5	16.13
		2017	2	6.45
		2018	10	32.26
		2019	1	3.23
		2020	4	12.9
		2021	7	22.58
	Affiliated Countries	Western Europe	28	90.32
		Eastern Europe	2	6.45
		Northern Europe	13	41.94
		Southern Europe	14	45.16
		Outside of Europe	9	29.03
	Number of Citations	0	3	9.68
		1-10	8	25.81
		10-20	5	16.13
		20-50	8	25.81

Focus	Dimension	Values	Results	
			Studies	**Percentage** (%)
		100-200	6	19.35
		200+	1	3.23

Degrowth Focus
Within the degrowth focus, it is notable that the overall sentiment of the papers towards degrowth (29 positive and 2 negative) and conviviality (20 positive and 0 negative) is very positive, while the overall sentiment towards green growth is negative (21 negative and 6 positive). For instance, Pansera et al. (2019) mention both positive and negative aspects of degrowth. In this paper, the authors express a positive attitude towards the degrowth principles of respecting the natural limits of the Earth and reducing consumption. On the other hand, the authors express their doubts about the feasibility of the principles at both regional or global scale, as there are only a few practical examples on a small scale. Within the dimension relation focus, there were 19 papers discussing degrowth of ICT and 16 papers discussing degrowth by ICT, of which 6 papers discuss both topics and 2 papers that discussed neither of those topics. Although degrowth of ICT is discussed slightly more than degrowth by ICT in the papers, the results of the Q-sort made it clear that the factors do not want to realize degrowth of ICT in their daily lives, while they were significantly more positive about degrowth by ICT. Besides that, there were several types of degrowth discussed in the papers, the most prominent ones being consumption, physical and radical (20, 17, and 20 times respectively), while agrowth, GDP and work-time were only discussed a small number of times (5, 5, and 1 time respectively).

Change Focus
Within the change focus, it is notable that the papers concentrate more often on gradual change (19 times) compared to radical change (13 times). Notably, gradual change was broadly preferred over radical change by the participants of the focus groups, but this preference is less apparent in this division. One interesting paper that discusses both gradual and radical change is that of Zoellick & Bisht (2018). They suggest radical changes in laws and policies, in which gradual technological and societal changes are implemented. In relation to this, the theories and practices outlined in the papers were very often applied to the as-is situation as well as the to-be situation (both 29 times), while intermediate situations were described fairly less often (13 times). This provides opportunities to describe intermediate situations more often in order to clarify the pathway towards a to-be situation. Besides that, in most papers the degrowth principles were applied from the consumer side of the balance or more broadly by society in general, i.e. bottom-up (20 times), compared to top-down (14 times). Finally, the most prominent scopes of change were systemic by far (24 times) followed by cultural (14 times), while the other scopes were discussed only a few times (institutional: 6, interpersonal: 5, intrapersonal: 3). This indicates that there are openings for research in a smaller, individual scope such as intra- and interpersonal. The geographical scope is divided as well. 18 papers are globally applicable, while 12 papers are locally focused. It seems that national and international initiatives (with 4 and 5 cases respectively) are less popular as subjects of research. It seems that degrowth and ICT projects eschew larger governmental and corporate organizations in favor of local initiatives or NGO's, which have a more global reach.

Technology Focus
Within the technology focus, it is notable that regarding the dimension affected industries, the theories and practices of a paper generally concern either the Information and

Communication industry sector (16 times) or were generic, concerning multiple or all industry sectors (11 times). Interestingly, while the participants of the attitude study expressed positive opinions on using ICT to boost efficiency and sustainability in other industries, only four industry sectors (NACE codes A: Agriculture; Forestry and Fishing, K: Financial and Insurance Activities, P: Education and U: Activities of Extraterritorial Organisations and Bodies) were subject of specific research (Edwards & Espelt (2020); Macgilchrist (2021); Pollex & Lenschow (2018); Vitari (2014)). Besides that, the papers often advocated for a higher amount of digital technology, also defined as high-tech (27 times), whereas low-tech was advocated for only 11 times. This aligns with the results of the Q-sort, in which all factors agreed that the current level of ICT use was justified and definitely should not be decreased. This also presents an opportunity for degrowth research, as the low-tech route can be explored further with regard to the use of ICT. This aligns with the principle of 'least appropriate technology' from the interviews. This means that we, as a society, should decide what is the least amount of technology required to maintain the way we want to live in a degrowth society. We see that rebound effects are discussed in research, occurring 16 times in total.

Contribution Focus

Within the contribution focus, it is notable that most of the time the argumentation of a paper was a narrative (30 times), as they provided textual arguments based on scientific literature. The other argumentation types, (empirical) models and a theory, only occurred 3 times each. Besides that, while methods were present as takeaways (11 cases), only 2 papers created a tool, as a means to support a part of a process. Best practices concerning degrowth and ICT were mentioned 15 times. Finally, imaginaries on degrowth and ICT, which are shared values and norms common to the people included in the scenario allowing them to imagine a corresponding worldview, were quite common in the papers (24 times). This aligns well with the needs expressed by the interviewees when asked what they would want to read in a degrowth and ICT paper, as they wanted to read papers that include concrete methods, including values and norms, allowing us to grow towards a degrowth society.

Research Focus

Within the research focus, the most common research method was clearly the literature analysis, which was used 22 times. Case studies were used 6 times and surveys were used 3 times, while interviews and observations were used 2 times each. This represents a need for more practice-oriented research, as expressed by interviewee 4: "[We need] real life examples that try to address part of the critique. It's not possible to address everything. You need a lot of trial and error". This is also apparent by the lack of papers concerning a single institution as seen in the scope of change dimension. Furthermore, the methods of data analysis, design analysis, dialogue, experiment, technical report, and thought experiment were used once, while none of the papers included a focus group to conduct their research. To diversify the research field, more of these underutilized research methods could be employed for degrowth and ICT projects. Additionally, there is no significant increase in publications that can be identified over the years. 2018 was the most popular year until now, with a total of 10 publications. This could be explained by the three degrowth conferences held in that year, which is more than in any other year. It is notable that most authors of the papers are affiliated with countries in Western Europe (classified according to groupings of the United Nations (2010)), namely 28 out of 66 authors. Besides that, countries in Northern and Southern Europe also have many authors affiliated with them (13 and 14 respectively). Interestingly, Eastern Europe (2 authors) and other parts of the world (9 authors from either India, Egypt or the USA) are lagging behind with their number of affiliated authors in

the research field of degrowth and ICT. Finally, the papers that have been analyzed have a varying number of citations, from 0 to 358 citations. 3 papers in total did not have any citations, while there were 8 papers with 1 to 10 citations. Furthermore, 5 papers had 10-20 citations, 8 papers had 20-50 citations, and 6 papers had 100-200 citations. The paper from Kallis et al. (2018) stood out with a total of 358 citations. The large amount of citations divided over the papers indicate that there are many more papers that might discuss degrowth and ICT, without explicitly using these terms.

7 Discussion

In this section we discuss possible limitations to our results and indicate possibilities for further research.

7.1 Limitations to the mapping study

We have chosen to include usage of the term 'degrowth' as an inclusion criterion for the literature search that provides the corpus of publications for the mapping study. This was done to reduce ambiguity concerning the inclusion of papers that border on being in line with degrowth principles. Consequently, this excludes all publications that concern ICT, and embrace these principles of degrowth but do not use the term explicitly. This will likely mean that we have excluded many publications from the USA, as the interviewee in interview 1 mentions: "degrowth is a harder word to use there [in the USA], you mark yourself as an extremist so Americans sympathetic to the ideas might not use the term". This affects the completeness of the mapping study, as there will be many papers (most likely from outside the degrowth community) that were suitable for inclusion in the framework, but have not been considered. This opens up a future direction of study which would aim to more accurately define these inclusion criteria and expand the framework with additional mapping studies. To gain insight into how this would affect the framework, we have analyzed one paper that we found to align with degrowth principles, namely a paper on limits-aware computing by Chen (2016). This paper is included in the mapping study in appendix G in red. *Note that the results from this mapping are not counted for the results of the mapping study!* Although the paper did not mention degrowth, it aligned with the dimensions of the framework well. Looking at the results of the mapping study, there is a lack of narrow-focus content. Looking at the much larger body of work concerning ICT (compared to degrowth), it is expected that if the inclusion conditions of the mapping study were relaxed more of this research content would be found. It is therefore an interesting avenue of future research as a clearer picture of the research field could be presented, including specific industry sectors where research is lacking. More dimensions and values could most likely be conceptualised from this research as well.
The mapping study was conducted by two researchers. In mapping the papers to the values of the framework, ambiguity is always present. This might slightly affect the results of the mapping study, as different persons would map a paper in mildly different ways. In order to account for this, before the main mapping study the researchers have mapped some duplicate papers in order to identify ambiguous dimension and value definitions, which were subsequently revised. Only a handful of different mappings occurred during this trial, so we do not judge this to affect the results in a meaningful way. The limitations of the attitude study also affect the construction and refinement of the framework. Because of the limited perspectives offered (as mentioned in the section below), the framework excludes dimensions and values from these underrepresented perspectives. Additional attitude studies and mappings could serve to extend the framework with these additional information.

7.2 Limitations to the attitude study

The interviewees were experts from the degrowth community or otherwise positively inclined towards degrowth. This has created a positive bias towards degrowth in this section of the results. The interviewees were purposefully selected from the degrowth community in order to obtain a more consistent perspective on the relationship between degrowth and ICT for the conceptualization of this relationship. As this research project offers the tools to explore this relationship further, a more diverse set of interviewees such as ICT experts, or additional focus groups could serve to make the framework and attitude study results more complete.
The Reddit survey results are biased towards a few subreddits that were more active in answering both open and closed questions. These communities were SR2, SR4 and SR12, which is the collapse subreddit, the neoliberal subreddit and the zero-waste subreddit. While the open questions are separated by subreddit (and are included as such in the Q-set concourse), the answers to the closed (Likert-scale) questions are not separated. Results from these more active communities might be over represented in the analysis. As the more active communities are mixed in degrowth valence (one mostly positive, one mostly negative, one ambivalent) we do not judge this to negatively affect the results. Another note is that the use of the term ICT is less prevalent in North America than in Europe. Since over half of Reddit users are from the USA and Canada according to the April 2022 usage statistics (Semrush, 2022), this might have affected the answers of those respondents. We have attempted to mitigate any misunderstandings by offering explanations of the term when asked.
Figure 16 illustrates the eigenvalues of each factor in relation to each other. We can see that the eigenvalue of factor 1 is much higher than all other factors, while the rest of the eigenvalues are quite similar in comparison. In comparison to factor 2, which only has one less loading participant, factor 1 has an eigenvalue many times higher. This means that the loading participants of factor 1 are very closely aligned with the factor values. A possible explanation for this is that participants found it easy to agree with statements concerning the environment. We see this reflected in the generally positive scores concerning those statements. Therefore, a more climate-sceptic perspective was underrepresented in the results of the attitude study. In order to rectify this, we have conducted four additional q-sortings after the initial 30 participants, with participants selected for their pro-growth attitudes. One more limitation to the Q-sort participants is that all participants were from a developed nation. Either owing to the geographical proximity to the researchers, or owing to their internet access (and use of Reddit) to complete the sorting. Thus, perspectives from less developed countries (or any countries from the global south) are not represented in the attitude study.
Q-sort as a method has a limiting factor, in that the opinions and attitudes expressed in the study are not proved to be consistent over time. The method makes no claim to this, but it should be taken into account that a given sorting is a representation of a personal opinion at a specific point in time. As Watts & Stenner (2005) mention, the same person can express different opinions across time. In sorting the Q-set they express an opinion that they hold *at that time*. For our research, this means that attitudes towards degrowth and ICT as expressed in the attitude study are similarly positioned. The entirety of the conclusions of the attitude study are representations of generalised attitudes within the participant groups, which are not necessarily consistent across time and across persons.

In order to reach a wider selection of participants, the Q-set was translated into Dutch. We do not differentiate between results of a given sorting based on the translation of the statements. Care was taken to translate the statements as accurately as possible,

but minor semantic differences or ambiguity could have been introduced to the Q-sort process. This might affect the replicability of the results.

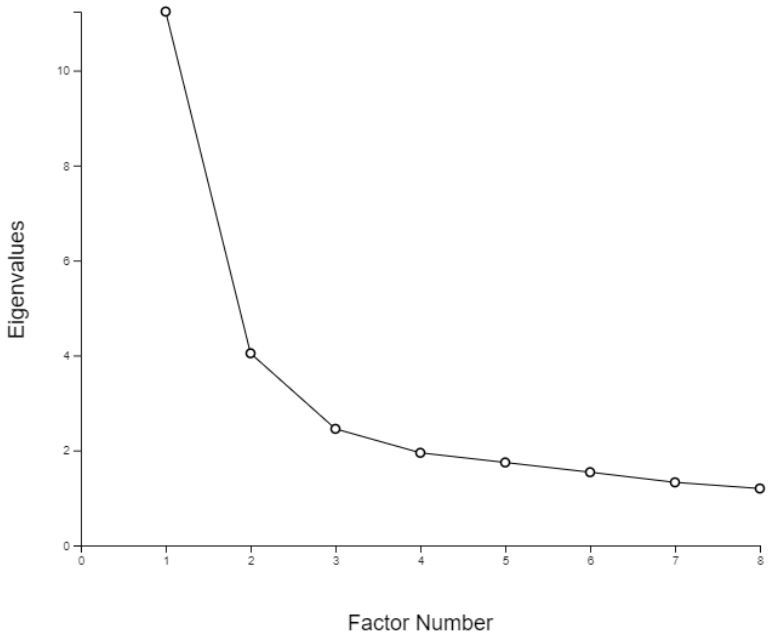

Figure 16: Scree plot of eigenvalues per factor.

8 Conclusions

We conclude by summarising important findings of this research, and providing recommendations for future research into degrowth and ICT.
Firstly, we provide a robust and extendable conceptual framework that can be used to provide insight into research concerning these two subjects. The mapping study provides insight into the state of the art of the field, but it also offers avenues for further expansion of the framework and inclusion of more papers that embody degrowth principles. Important findings from the mapping study include:

> The principles of low-technology are represented in literature, but could serve as a basis for retooling how we think about our use of ICT, and replace our view of these technologies as a panacea.
>
> The institutional and interpersonal scope are relatively unexplored. These scopes are important, as they can serve as practical examples of how people and corporations can utilise ICT in a degrowth-oriented world on a smaller, more relatable scale.
>
> There is a need for practice-oriented research concerning degrowth and ICT. The field is already heavily populated with literature studies but can gain from more case studies, experiments etc. to validate how ICT and degrowth work together in real-world scenarios. This research should do well to include perspectives that

address gradual change, rebound effects and green growth in line with the results from the attitude study.

The attitude study provides multiple perspectives which can be used to provide context and gauge reception of degrowth and ICT projects should they be implemented. Important findings from the attitude study include:

> Successfully implementing degrowth of ICT means acknowledging the reluctance of people to reduce the amount of ICT they use in their daily lives. Tackling the climate crisis through degrowth will require a reduction in global production and consumption of resources, this too will apply to ICT. People are largely inclined towards the continued use of ICT in their lives as well as in making businesses more efficient and sustainable. Both degrowth *of* and *by* ICT should do well to take this into account.

> People are more inclined towards gradual change, eschewing radical change and terminology, this includes the term 'degrowth' itself. Degrowth principles however, are more readily accepted. Placing this in the context of ICT, implementing these principles is more readily accepted when not portrayed as radical change, even though it might involve the paradigm shifts and rapid pace associated with this type of change.

Lastly, we underscore the importance of addressing the inherent connection and contradiction between degrowth by ICT and degrowth of ICT. Using ICT to implement degrowth principles will create dependency on these systems. In this light, it is critically important that degrowth of ICT is taken into account when executing degrowth by ICT projects. This can take the form of prioritising low-tech solutions that decrease the total amount of ICT used, or mitigating this dependency by designing for conviviality. We see that the relationship between degrowth and ICT has many facets, and that many perspectives fill the imaginaries that help us (or harm us) when imagining a hopeful future. Growth or degrowth-oriented, ICT will hold a place in our future, and it is up to those that design, maintain and use it to imagine how this place will look.

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Appendices

A Literature Search Protocol

The search strings S1 through S6 were applied to search platforms P1, P2 and P3 (as in table 7). For platform P4 (the degrowth.info library), the tags examined were 'communication' and 'technology'. The entry type was set to 'scientific paper'. The results of each search string and platform combination were examined by reading the title and abstract. If the topic of the paper included both ICT and degrowth (as described in section 2.1), it was included in the corpus. For the purposes of the mapping study we only include papers that include the term 'degrowth', disregarding papers that embody the principles of degrowth but do not use the term. For the results per search string and platform, see next page. So-called seed papers formed the initial inspiration for this project, no source is provided for these papers. See table 7 for an overview of the search results. The first column lists the search platforms, the second column lists the total amount of papers (including duplicates) that aligned with the initial inclusion criteria as described above per platform. The third column lists the amount of unique papers that were found, and the fourth column lists the amount of papers that were included in the mapping study. See the next page for the search results per paper, based on term and platform.

Search strings

S1 "Degrowth" "ICT"

S2 "Degrowth" "Software"

S3 "Degrowth" "AI"

S4 "Degrowth" "Computers"

S5 "Degrowth" "Internet"

S6 "Degrowth" "Technology"

Search platforms: results examined per platform, per string

P1 Google Scholar: 50 results

P2 Semantic Scholar: 50 results

P3 RefSeek: 100 results

P4 degrowth.info library: 82 results

Table 7: Search results and inclusions per platform

Search Platform	Total per platform	Unique Studies	Included Studies
Seed	7	7	5
P1	50	18	17
P2	23	3	3
P3	21	5	3
P4	11	6	3
Total	105	39	31

Paper	Source																		
	Seed	P1						P2						P3						P4
		S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6	
Abbing (2021)		1			1			1						1			1			
Betzler (2016)																				1
Bonauiti (2018)		1			1	1								1						1
Chen (2016)																	1			
de Valk (2021)															1					
Drews & van den Bergh (2016)	1																			
Edwards & Espelt (2020)		1	1			1						1								1
Garcia & Horstink (2014)																				1
Garcia, Jeronimo, & Carvalho (2018)	1	1					1					1								
Haucke (2018)	1	1																		
Heikkurinen (2016)						1	1		1			1								
Howson (2021)			1			1	1					1						1		
Ibrahim & Sarkis (2020)							1							1					1	
Kallis et al. (2018) (303-306)		1			1		1		1	1		1								
Kerschner et al. (2018)		1	1	1			1			1				1				1		
Kirchherr, Reike, Hekkert (2017)	1																			
Kostakis et al. (2016)		1	1		1	1		1	1											
Likavčan & Scholz-Wäckerle (2016)																				1
Macgilchrist (2021)												1								
March (2018)		1					1	1				1		1				1		1
Navarro-Remesal (2019)															1		1			
Pansera, Ehrichs & Kerschner (2019)	1	1		1	1	1	1	1				1								
Pérez-Garcia (2018)		1												1						
Pollex & Lenschow (2018)												1								
Pueyo (2018)	1	1	1	1	1										1	1	1	1		
Puglia et al. (2014)																				1
Pyakurel (2021)							1					1								
Raghavan & Parman (2017)					1															
Rasillo (2020)															1					
Rossi (2016)		1	1			1														
Samerski (2016)			1		1					1		1								
Santarius, Pohl & Lange (2020)														1						1
Welfens, Nordmann, Seibt & Schmitt (2014)																				1
Temmerman & van den Broeck (2021)		1																		
Vitari (2014)			1			1						1								1
Westermayer (2014)																				1
Widdicks et al. (2018)	1																			
Zoellick & Bisht (2017)												1						1		

B Focus Group protocol

The goals of conducting the focus groups are as follows: they provide input for the conceptual framework, including additional dimensions or variables. The results also provide focal points for the research or framework. By asking the right questions, valuable data can also be collected on the relationship between degrowth & ICT. This data will illustrate the attitudes of the participants towards the mentioned concepts and thus fulfill the goals of the attitude study. The participants of the four focus groups were between 6 and 8 masters students, who took part in the focus groups as part of a university course. The sessions lasted for 45 minutes each. For each session, audio recordings were made and notes were taken by the mediator.

Mediator script:
Hello and welcome to this focus group. My name is Willem. I am a second-year Business Informatics student. I am interested in the topic of degrowth and ICT and I will start my thesis next period under Sergio's supervision, precisely in this topic. That is why Sergio has invited me to moderate these focus groups. We will spend the next 45 minutes discussing the topic of degrowth and it's relation to ICT. We are going to record this discussion because we do not want to miss any of your comments. We will not share this recording with anyone outside the research team. No names will be included in the reports. Your comments are confidential. Does anyone have concerns with us recording the session? (Sergio will now say this sentence: If you have concerns, please say so, there will be no consequences with respect to your participation in the course, your grades or our consideration towards you.) Then we will use the collected data in two ways: We will distill the main highlights and conclusions, and we will try to share those with you later in the course. We will also use the data as an input for my later research, analyzing it more in depth. There are some ground rules. There are no wrong answers. We expect that you will have differing points of view. Please share your point of view even if it differs from what others have said. We have our names here in front of us. They help us remember names, but they can also help you. Don't feel like you have to respond to me all the time. If you want to follow up on something that someone said, you want to agree, or disagree, or give an example, feel free to do that. Feel free to have a conversation with one another about these questions. I am here to ask questions, listen and make sure that everyone has a chance to share. We are interested in hearing from each of you. So, if you are talking a lot, I may ask you to give others a chance. And if you are not saying much, I may call on you. We just want to make sure that all of you have a chance to share your ideas. If you have a mobile phone, please put it in quiet mode and, if you really need to answer, step out to do so.

> "Before we begin, I would like to go around the group one at a time, and have everyone tell us their name and master programme. Also, please please mention one of the things that you value the most in your life (i.e. one among the top 5). There are no wrong answers and you do not need to be original in your answer, so we recommend you not to overthink it. Just say aloud one of the things that you consider important in your life"

"We are not going around the group anymore. So just jump into the conversation whenever you want. If you realize, most of you have mentioned things that have little to do with what you own. Even when they may be related to our idea of progress (e.g. we assume that in order to have good health, a good healthcare system with the appropriate professionals, resources, processes and technology is needed), they are rarely expressed in terms of monetary wealth, GDP, industrial capacity or even technology. Degrowth talks about fostering all these things, without compromising the planetary limits, without

harming others."
"To explain degrowth in concrete terms.Degrowth is an ideological concept that seeks to find a solution to the problems created by the paradigm of economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale. It seeks to shift the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale).
This is not to say that we should cease growing and innovating! But it means that we need to consider planetary limits. We can explain this with an analogy."
Think of a turtle. When it is a baby, it will fit inside a small tank. It then starts growing, but only until it reaches a size that is ideal for the size of the tank it is in. If you then put it in a bigger tank, it will resume growing, but stop before it gets too big. The turtle stops growing, because it would be unsustainable to outgrow its tank. This does not mean that the turtle stops developing. Its shell gets thicker, its colors grow more beautiful and the small turtle gets smarter too." We would like to know your opinion about degrowth. Please remember that you are entitled to your own opinion, that you do not need to please anyone, and that there are no wrong answers.

Q: What do you think of the degrowth concept? Do you feel sympathy for it or not? Please summarize why.

Q: There is a discussion in the degrowth community regarding change. One side says radical change is needed in order to affect the system, but others maintain it can only be done through gradual change. What is your view on this? Can you for instance name examples of clear gradual or radical change?

Q: Do you see any relationship between ICT and regrowth that could be interesting to explore by academia or practitioners? Or are they rather two completely unrelated domains? Remember that this is about opinions and any contribution could lead to an interesting reflection, so there is no right or wrong answer... For these examples, you can think of specific industry sectors or if it concerns gradual or radical change.

Q: Imagine that you have a paper on degrowth and ICT in front of you. What should the paper be about so that you are interested in reading it?

Q: Now what should the paper be about for you to decide "No, I pass, I'm not reading this paper"?

Q: If a research team wanted to investigate in depth the phenomena and theories around ICT and degrowth, considering all the relationships that you just mentioned earlier, what relevant aspects of these relationships could they focus on?

Short description of thesis project ($\tilde{5}$-10 minutes) So, we are trying to create a conceptual framework of research on ICT and degrowth. Think of this framework as a template to categorize papers in this area along many dimensions. One simple dimension is determining whether a given paper is about degrowth of ICT or whether it is about regrowth by ICT.

Q: What do you think are important dimensions that we could include in our conceptual framework?

C Interview protocol

The goals of the interviews are twofold: we gain qualitative data on the attitudes of interviewees towards degrowth and ICT, and we gain expert opinions on the conceptual framework which we can use to evaluate existing dimensions, or add new dimensions. The interviewees were found by web search or recommendations of other interviewees. They were included because of their affiliation with the degrowth community, either by conducting degrowth-oriented research or otherwise.

1: This interview will be recorded. Your data will be anonymized, and compiled with other interview data to allow for expansion and validation of our research. Is that okay with you?

2: My name is Willem. I am a second-year Business Informatics student. I am interested in the topic of degrowth and ICT and I am conducting my thesis research under Sergio's supervision, precisely in this topic. The specific topic of my research is into the relationship between degrowth and ICT. The goal of this interview is to establish your opinion on these two concepts and their intersections, and to look at this relationship in detail.

Q1. Now that you know about me, could you introduce yourself? What is your link to degrowth?

Q2: What do you think of the concept of degrowth?

Q3: How do you think other people feel about the principles of degrowth?

Q4: What do you think of the term degrowth?

Q5: Do you think it is difficult for people to imagine a better (or different) economic system?

Q6: Do you think people have many preconceptions about degrowth? If so, what are they? We are interested in both negative and positive attitudes and preconceptions.

Q6b: Are any of these preconceptions wrong or misguided?

Q7: What do you think of the idea that efficiency gains (for instance those created by innovation in ICT) will eventually enable us to keep growing the economy without increasing the impact we have on the natural world and humans (also known as green growth)?

As we said earlier, we are investigating the relationship between ICT and degrowth. The first evident distinction is applying degrowth principles to the ICT domain (which can be referred to as degrowth of ICT), and using ICT to apply degrowth principles to the whole economy (degrowth by ICT). W.r.t. Our conceptual framework, we call this a dimension which has 2 values.

Q8: What dimensions or values do you think that could be relevant for the conceptual framework and the mapping study?

Q9: Imagine that you have a paper on degrowth and ICT in front of you. What should the paper be about so that you are interested in reading it?

Q10: Now what should the paper be about for you to decide "No, I pass, I'm not reading this paper"? Overall research

Q11: What should our research emphasize so that people will want to read it?

Q12: Do you feel we have missed talking about anything in this interview, or is there an important aspect you feel we should not forget to take into account during our research?

Thank you very much for your time and your attention.

D Reddit survey

In order to gather a broad collection of opinions and statements regarding degrowth and ICT, the popular web forum Reddit.com will be used as one of the sources. In 2021,Reddit had approximately 1.7 billion monthly visitors (Semrush, 2022) and, therefore, many different opinions can be retrieved by both examining existing posts and creating new posts, which are designed with this research project in mind.The purpose of this is to expand the concourse and provide data for the attitude study. It is a way to reach a larger audience all over the world, in order to capture an as broad as possible set of opinions and statements. Besides that, the answers to the posts will be used to validate and support the results of the Q-sorts and the Q-set, which is the set the statements that have been derived from expert interviews and existing literature. In order to do so, there are two types of posts that are submitted in the different subreddits in table B1.

Type 1
A post containing a single open and broad question regarding either degrowth in general or degrowth & ICT. These questions will help gather opinions regarding degrowth and might ignite a discussion in the comments, which will contribute to the concourse.

Type 2
A post containing both a survey that consists of open questions, regarding degrowth in general, degrowth & ICT, and/or statements in the Q-set, and a survey that consists of closed questions regarding the statements in the Q-set. The lay-out of both surveys can be found in section D.1 at the end of this Appendix.
Most of the posts, except the post for subreddit SR1, contain the following definition of degrowth:
Degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift the focus from welfare (more customers, more profit, more growth) to wellbeing (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
The answers to the survey with open questions will contribute to the concourse and might provide interesting insights into the opinion of the wider audience. The results of the survey with closed questions is used to test the statements in the Q-set regarding general opinions and to validate the answers from the expert interviews regarding preconceptions of degrowth. Besides that, the results are used in the analysis of the attitude study. The closed questions are answered using a 5-point Likert scale (strongly disagree to strongly agree). Based on the rules of each subreddit, the expected knowledge of the users about degrowth and the type of subreddit, there are also some variations within the two types. The final set of posts can be found below Table 8.

Table 8: Overview of subreddits

ID	Link	# Members
SR1	https://www.reddit.com/r/Degrowth/	3k
SR2	https://www.reddit.com/r/Collapse/	415k
SR3	https://www.reddit.com/r/SampleSize/	184k
SR4	https://www.reddit.com/r/neoliberal/	134k
SR5	https://www.reddit.com/r/Capitalism/	53k
SR6	https://www.reddit.com/r/AskReddit/	35 million
SR7	https://www.reddit.com/r/Environment/	902k
SR8	https://www.reddit.com/r/Environmental_science/	42k
SR9	https://www.reddit.com/r/Anticonsumption/	379k
SR10	https://www.reddit.com/r/Economy/	870k
SR11	https://www.reddit.com/r/Anarcho_Capitalism	186k
SR12	https://www.reddit.com/r/ZeroWaste	785k
SR13	https://www.reddit.com/r/Sustainability/	163k
SR14	https://www.reddit.com/r/TrueAskReddit/	242k

Note: owing to subreddit rules, some posts were altered. The post on SR5 was immediately removed without reason. The post on SR 7 consisted of only a title and link. The posts on SR 12 and SR14 did not have links to the survey as they are disallowed.

Posts per subreddit

Post 1 - Type 1 - SR1
Note: The users on this subreddit are generally more knowledgeable about degrowth,hence the different type of question.
Title: How do you think degrowth and ICT are related? Can ICT support the principles of degrowth? How can degrowth be realised within the ICT industry?
Additional text: Currently ICT is used to improve efficiency, accuracy, and consistency within different processes to support the idea of economic growth at all costs. How can this role of ICT be changed in order to support the principles of degrowth, if there is any role for ICT at all? An example-usage of ICT to support the principles of degrowth are the digital commons, which are information and knowledge resources that are collectively created and owned by a community and are freely available to third parties. How do you think the degrowth principles can be realized within the ICT industry itself? An example of realizing the degrowth principles within the ICT industry is to create devices and machines that simply last longer. Historically, machines were made to last, but currently companies create, for example, smartphones in such a way that you need a new one every few years. It would be nice to see your opinions on this relation between degrowth and ICT. Feel free to discuss with others in the comments, but always keep it polite. Thanks for your reaction in advance :)

Post 2 - Type 1 - SR8
Note: The users on this subreddit are generally more knowledgeable about degrowth,hence the different type of question.
Title: How do you feel about degrowth and its relation with ICT?
Additional text: Degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift

the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
In case you are interested in this concept and want to read more about it, we would like to refer you to this website: `https://degrowth.info/degrowth`
Currently ICT is used to improve efficiency, accuracy, and consistency within different processes to support the idea of economic growth at all costs. How can this role of ICT be changed in order to support the principles of degrowth, if there is any role for ICT at all? An example-usage of ICT to support the principles of degrowth are the digital commons, which are information and knowledge resources that are collectively created and owned by a community and are freely available to third parties.
How do you think the degrowth principles can be realized within the ICT industry itself? An example of realizing the degrowth principles within the ICT industry is to create devices and machines that simply last longer. Historically, machines were made to last,but currently companies create, for example, smartphones in such a way that you need a new one every few years.
It would be nice to read your opinions on the concept of degrowth itself as well as your opinions on the relation between degrowth and ICT. Feel free to discuss with others in the comments, but always keep it polite. Thank you in advance! :)

Post 3 - Type 1 - SR12 & SR14
Note: Links to surveys are not allowed in these subreddits, hence the slightly different phrasing. **Title:** How do you feel about degrowth?
Additional text: Degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
In case you are interested in this concept and want to read more about it, we would like to refer you to this website: `https://degrowth.info/degrowth`
For a research project, we're interested in the general attitude of society towards this idea. So feel free to give your opinion and to start a discussion about this concept in the comments. Remember to keep it polite :)

Post 4 - Type 1 - SR6
Note: This subreddit only allows a title with a maximum of 300 characters, which contains a question. Additional clarification is provided as a comment.
Title *(only 300 characters):* What do you think of degrowth, which is a concept that critiques the global capitalist system that pursues growth at all costs, and instead pursues a world where environmental and social well-being are prioritized? Do you feel sympathy for it or not? Please summarize why.
Additional comment: Degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
For a research project, we're interested in the general attitude of society towards this idea. So feel free to give your opinion and to start a discussion about this concept in

the comments. Remember to keep it polite :)

Post 5 - Type 2 - SR2, SR4, SR5, & SR9
Title: Attitude study regarding degrowth and ICT
Additional text: Degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
In case you are interested in this concept and want to read more about it, we would like to refer you to this website: `https://degrowth.info/degrowth`
For a research project, we're interested in the general attitude of society towards this idea. We've created 2 surveys, one including closed questions and one including open questions. The first one will take approximately 5 minutes to fill in and the second one will take approximately between 10 and 20 minutes to fill in. Feel free to fill in both or only one of them. Thank you in advance!
Links to surveys
Also, feel free to start a discussion about the concept in the comments, but always keep it polite :)

Post 6 - Type 2 - SR3
Note: This subreddit is intended for research purposes and surveys, hence the different phrasing.
Title: Attitude study regarding degrowth and ICT
Additional text: Hi everyone, We are all aware of the environmental and societal problems in the world. An often mentioned cause of these problems is the global capitalist system that pursues growth at all cost. A possible solution could be degrowth, which is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. In case you are interested in this concept and want to read more about it, we would like to refer you to this website: `https://degrowth.info/degrowth` For this survey, we are interested in people's opinions regarding degrowth and ICT as part of a research project at Utrecht University. We've created 2 surveys, one including closed questions and one including open questions. The first one will take approximately 5 minutes to fill in and the second one will take approximately between 10 and 20 minutes to fill in. Feel free to fill in both or only one of them. Thank you in advance!
Links to surveys

Post 7 - Type 2 - SR7
Note: This subreddit only allows a title and a link, hence the different type of post.
Title: Attitude study - What do you think of degrowth, which is a concept that critiques the global capitalist system that pursues growth at all costs, and instead pursues a world where environmental and social well-being are prioritized?
Links to open question survey

D.1 Survey contents

Survey - open questions

Introduction
Thank you for wanting to participate in this survey!
For this survey, we are interested in people's opinions regarding degrowth & ICT as part of a research project at Utrecht University.
To explain degrowth in concrete terms; degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
In case you are interested in this concept and want to read more about it, we would like to refer you to this website: `https://degrowth.info/degrowth`
During this survey, you will be presented with several open questions, which we would like you to answer with your personal opinion. There are definitely no wrong answers and feel free to elaborate on your answers. It will take approximately 10-15 minutes to complete the survey, and your responses are completely anonymous!

Q1: What do you think of the degrowth concept? Do you feel sympathy for it or not? Please summarize why.

Q2: Do you think technological innovation should be the main focus for solving climate change or are there other things that should be prioritised, for example, reduction of consumption? Please explain why.

Q3: Who should take responsibility for solving climate change and societal problems?

Q4: Would you be able to still live a good live with less? What do you consider necessary to live a good live?

Q5: What do you think of the role and amount of ICT in (y)our daily life(s)?

Q6: What recent innovations have impacted your life? Are these innovations related to ICT?

Q7: Currently ICT is used to improve efficiency, accuracy, and consistency within different processes to support the idea of economic growth at all costs. How can this role of ICT be changed in order to support the principles of degrowth, if there is any role for ICT at all? An example-usage of ICT to support the principles of degrowth are the digital commons, which are information and knowledge resources that are collectively created and owned by a community and are freely available to third parties.

Q8: How do you think the degrowth principles can be realized within the ICT industry itself? An example of realizing the degrowth principles within the ICT industry is to create devices and machines that simply last longer. Historically, machines were made to last,but currently companies create, for example, smartphones in such a way that you need a new one every few years.

Survey - closed questions

Introduction
Thank you for wanting to participate in this survey!
For this survey, we are interested in people's opinions regarding degrowth & ICT as part of a research project at Utrecht University.
To explain degrowth in concrete terms; degrowth is an ideological concept that seeks to find a solution to the ecological and social problems created by endless economic growth. It does not do this by fighting symptoms, but by treating its root cause: reducing production and demand on a global scale, because infinite growth in a finite world is impossible. It seeks to shift the focus from welfare (more customers, more profit, more growth) to well-being (on a human and environmental scale). This is not to say that we should cease growing and innovating! But it means that we need to consider planetary and human limits.
In case you are interested in this concept and want to read more about it, we would like to refer you to this website: `https://degrowth.info/degrowth`
During this survey, you will be presented with several statements regarding your daily lives, the economic system, environment, consumption, and innovation, which you can either agree or disagree on. It will take approximately 10-15 minutes to complete the survey, and your responses are completely anonymous!

Q1: The global capitalist system works and should be maintained.

Q2: We should use other ways to measure progress, wealth, and well-being besides the gross domestic product (GDP).

Q3: The natural resources and materials are evenly distributed amongst the different parts of the world.

Q4: Global consumption of resources and demand for products should be reduced.

Q5: Innovation contributes to or helps solving environmental and societal problems.

Q6: The role and amount of ICT in our daily lives is appropriate and should keep developing as it currently is.

Q7: The amount of ICT we use in our daily lives should be reduced.

Q8: Reducing energy usage should be prioritised over switching to clean/green energy.

Q9: Radical change is more effective than gradual change.

Q10: It is possible to decouple economic growth from ecological impact, meaning that the economy can keep on growing without further harm of the environment.

Q11: Technical innovations should be used to stop exploiting nature, while maintaining the ability of economic growth.

Q12: Countries with a larger economy should contribute more to solving climate change.

Q13: Countries with smaller economies should be able to keep growing.

Q14: To be able to innovate, we require economic growth.

Q15: To be able to innovate, we require ICT.

E Q-sort protocol

Participants were initially selected by the researchers on the basis of logistic availability, as the intention was to conduct the sorting physically, and the participant group thus includes people from the direct and somewhat more indirect surroundings of the researchers. Care was taken to not over-represent one group such as university students or young people. All participants were from developed nations however, as discussed in the limitations of the results.
In order to conduct most of the Q-sortings, we have used individual cards with the statements printed on them. Participants could place these cards on a template representing the different scores. Some Q-sortings (participants 31-34) were conducted online using a spreadsheet.

E.1 Q-set concourse

Table 9 lists the concourse for every Q-set statement. These are sources from both literature and results of the different parts of the attitude study. Some statements also include quotes attributed to public figures or grey literature. Quotes and excerpts are original, with flaws and spelling left intact.
Abbreviations used:

I* Interview, plus number identifier.

FG* Focus group, plus number identifier.

RS* Reddit survey comments, subreddit identifier as in appendix D.

RSO Reddit survey reponses to the open questions.

LiM Less is More, book by J. Hickel (2021)

SiB Small is Beautiful, book by E.F. Schumacher (1973)

Table 9: Concourse excerpts corresponding to each Q-set statement

ID	Source : Excerpt
1	I3: "Although there has been such a criticism against GDP as a measurement of success or normative goal to realize, governments are still insisting on using GDP. Why?" I6: "For example, start discussing the need to overcome GDP as a measure" RS2: "i like the idea of a "stock market" that rewards stability rather than growth and is based on multi year projections and performance rather than quarterly profits and market share." RS12: "For me it's obvious at the macroscopic scale that we can't continue measuring progress in material gains for the reasons others point out." RS12: "I think it's an important counterbalancing concept to check how overly dogmatic our emphasis on GDP above all else is." RS12: "I am hopeful that the shifting away from GDP based societies to well-being focussed ones may not be so scared of degrowth, because it is truly the only way out of the climate change and all related crises (there is no such thing as sustainable consumption, no matter what the sustainable development goals say). In terms of the well-being stuff, Scotland, Iceland, and New Zealand founded the well-being economy governments group a couple of years ago. Scotland is currently doing a trial in Clackmannshire, I believe, to look at what measurements (qualitative and quantative) could make up the 'dashboard' that will show whether well-being is improving or not. This dashboard is ideally going to look different in different places, and will probably build on various policies like the twenty minute neighbourhood and active travel, etc." LiM p93: "Today, nearly every government in the world, rich and poor alike, is focused single-mindedly on GDP growth." SiB: "The substance of man cannot be measured by Gross National Product." Kuznets (1934): Economic welfare cannot be adequately measured unless the personal distribution of income is known. And no income measurement undertakes to estimate [...] the intensity and unpleasantness of effort going into the earning of income. [...] The welfare of a nation can, therefore, scarcely be inferred from a measurement of income as defined above. Pansera et al. (2019): "despite years of accumulating evidence that economic growth is a poor universal indicator for human well-being, primarily because ever less people are benefiting from this growth (Hickel & Kallis, 2019; Hickel, 2018; Piketty, 2014)." Hickel et al. (2021): "Policymakers commonly regard economic growth as a proxy for human development and social progress. But past a certain point, which high-income nations have long exceeded, the correlation between GDP and social indicators breaks down or becomes negligible."
2	RS4: "The World is more abundant than ever before, we are yet to run out of any non renewable recourse and the time scale towards depletion has been repeated pushed back. (despite population growth and increased consumerism)" LiM p26: "I'm sorry to say we're capitalists, and that's just the way it is" SiB p148: "Dr Sicco Mansholt, one of the most prominent chiefs of the European Economic Community, may be quoted as a typical representative of this group. 'More, further, quicker, richer,' he says, 'are the watchwords of present-day society.' And he thinks we must help people to adapt 'for there is no alternative." Margaret Thatcher: "There is no alternative"

ID	Source : Excerpt
3	FGB: "It sounds like holding back a company in developing. Development is good for a company. Who is going to tell a company they can or cannot develop anymore." RS2: "When the growth stops, capitalism dies (yay!) and takes almost everything with it (dammit)." RS2: "Our world of globalization and pollution is intricately woven into the fabric of our existence. Ocean freighters filled with ores of many types, FF's, grains and container ships of consumer goods. Stop or restrict any and you have collapse practically overnight." RS4: "Trying to reduce global economic output sounds like a recipe for disaster. I don't even know how you'd want to achieve that but it would certainly greatly exacerbate global poverty." RSO: I think degrowth policy would lead to a significant worsening of poverty, in both the global North and South, even if its policies were only to be implemented in the North. The negative impacts of degrowth policy would likely far outweigh the benefits of reduced ecological destructions and the delay in climate change, it might bring about. LiM p76: "My opponent stood up and argued that there's nothing wrong with capitalism as such. The problem is that capitalism has been corrupted by greedy CEOs and venal politicians. All we need to do is deal with the bad apples and everything will be fine." Murray Bookchin: "Capitalism can no more be persuaded to limit growth than a human being can be persuaded to stop breathing"
4	RSO: "as well as desire for many developing countries to achieve higher living standards." LiM 169: "Growth is responsible for the extraordinary improvements in welfare and life expectancy that we've witnessed over the past few centuries" Easterlin (1974): "We must be highly skeptical of the view that long term changes in the rate of growth of welfare can be gauged even roughly from changes in the rate of growth of output (Abramowitz 1959)."

ID	Source : Excerpt
5	FGB: "Big companies emit a lot of greenhouse gasses, so if they can optimise their production processes they can become more green" RS4: "The digital revolution has led to a decoupling of economic growth and physical materials. We can have economic growth and ecological sustainability." RS4: "Focusing on decoupling is the way to go, not degrowth." RS4: "Decoupling is definitely possible." RS9: "If you can decouple economic growth from resource consumption- renewable energy, circular economy, etc, then this is not essential" RS12: "There is harmful growth like using more and more resources which are finite. However I would not say that all growth is bad. Economic growth can also mean more efficiency. If a factory can produce twice as much while consuming the same amount of energy (with automation, technology, etc.) that factory would have grown by 100%. The produced good are also cheaper. You see also tech companies that grew very fast in the recent decades. A lot of them helped society consuming less resources, e.g. having an ebook reader instead of owning dozens of books, using the internet instead of buying newspaper or books (think about wikipedia), using zoom conference instead of flying thousands of miles, home office, one truck delivering 100 packages instead of 100 people driving to the mall and buying the stuff, and so on. The US had economic growth but it also reduced CO2 emissions in the recent years. Many industrialized countries did (look at northern Europe countries). I think growth is fine as long as it is sustainable and less resources demanding and I think that's possible:" LiM p143: James Ward: "We conclude that decoupling of GDP growth from resource use, whether relative or absolute, is at best only temporary. Permanent decoupling (absolute or relative) is impossible for essential, nonsubstitutable resources because the efficiency gains are ultimately governed by physical limits. Growth in GDP ultimately cannot plausibly be decoupled from growth in material and energy use, demonstrating categorically that GDP growth cannot be sustained indefinitely. It is therefore misleading to develop growth-oriented policy around the expectation that decoupling is possible. " Hickel et al. (2021): "To reconcile growth with the Paris Agreement goals of keeping global warming below 1.5.°C or 2.°C, existing scenarios gamble on dramatic technological change, particularly negative emissions technologies and productivity improvements big enough to drive absolute decoupling of gross domestic product (GDP) from energy use."

ID	Source : Excerpt
6	FGD: "When has degrowth succeeded? When we use resources within planetary boundaries? Is it possible to have fairphone on the scale of apple or samsung? If a degrowth company grows to this scale, is it not an inherent contradiction? " I3: "In the end it is very political, so we have to convince people, different social classes, to have a happy life in post growth or degrowth environments. We also have to create and demonstrate certain ways according to which people can still have a meaningful and happy life with electricity and internet in a post growth manner." I5: "All these fields of collapse computing, that is one of the subtracks of the computing within limits literature, is something that is highly interesting in the sense that it basically means there should not only be internal principles of degrowth in ICT but also thinking that ICT is forced to degrow at some point. Not in a deliberate way, but in a way that the rare minerals, or metal industry will at some point have radical changes because of war or whatever reason you can imagine, and that ICT might need to degrow radically at some point or might become super expensive at one point, which is not pure fiction. If you start thinking about those things, then you need to anticipate for systems, programs, and infrastructures that can survive and anticipate the needs of this highly potential near-future." RS2: "Because if we decide to go the route of Degrowth, we need to answer the question of what that means for the common person. What it will probably mean is immediate economic shock, followed by years of economic hardship for a group of people (Millennials and Gen Z) that have had no favors economically in the last two decades." RS2: "This is not some abstract distant change; there is no pain-free way of switching away from the growth model. If done at any speed - as it must be - then hundreds of millions, perhaps billions of people, will no longer be able to feed and support themselves. It would make the post-2008 austerity policies look like a gentle tickle. In fact the only thing that might kill more people than intentional degrowth, would be the outright planetary ecocide we're currently on course for." Hickel et al. (2021): For high-income countries, continued economic growth may not be necessary. Instead, they can adopt post-growth policies, which are designed to keep economies stable and support strong social outcomes without economic growth
7	I1: "So degrowth, I can see is hard to sell. And perhaps strategically it is a better idea to market the ideas behind degrowth instead of the term." RS2: "I think intentional degrowth is an awesome concept, but there's very little political will for it, especially from the industrialists that would have to make the most substantial changes in order for it to be effective." RS12: "For some reason politicians are enamored with economists, and if nine out of ten economists tell them growth is sustainable and desirable it doesn't matter how many physicists, biologists and climate scientists are screaming about our current trajectory pointing straight to hell." LiM p27: "In 2019, the European Council on Foreign Relations asked an even stronger version of this question to people in fourteen EU countries. They phrased it as: 'Do you believe that environment should be made a priority even if doing so damages economic growth?' Surely people would be hesitant to agree with this kind of trade-off. Yet in almost all cases, large majorities (between 55% and 70%) said yes."

ID	Source : Excerpt
8	FGD: "There are some industries that we should not stop growing, like healthcare, education" RS2: "I.E certain industries should shrink while others grow to help transition us to a more sustainable future." RSO: "But I also feel like the usual representations of solutions are very naive, and do not take into account the reasons why growth is deemed necessary and how those problems can be addressed. For example retirement systems and growth of healtcare needs" LiM p33: "What does this look like in practice? The first step is to get past the irrational belief that all sectors of the economy must grow, all the time. Instead of mindlessly pursuing growth in every sector, whether or not we actually need it, we can decide what kinds of things we want to grow (sectors like clean energy, public healthcare, essential services, regenerative agriculture – you name it), and what sectors need to radically degrow (things like fossil fuels, private jets, arms and SUVs)" Hickel et al. (2021) "Finally, it is important to take global justice considerations into account. Existing climate scenarios maintain a significant disparity in per capita energy use between the Global North and Global South26,27. There is some relative convergence in certain scenarios, but none assume an absolute convergence. This approach is morally problematic, politically untenable (why should Global South negotiators accept such scenarios?), and potentially inconsistent with human development objectives. Instead, we should explore convergence scenarios, reducing excess throughput in the Global North and increasing necessary throughput in the Global South so that energy and resource use converge at per capita levels that are consistent with universal human welfare and ecological stability."

ID	Source : Excerpt
9	FGC: "Not exactly realistic for the global population to focus on degrowth. We first have to focus on enabling people to sustaining themselves." I3: "People from the global south may understand what degrowth means, but they might say: "okay, the global north had the opportunity to have an economic growth and the negative externalities of your growth created many problems in our land and now you're telling us that we should stop growing because of the mess that you have been creating. We're not going to degrow, you should degrow" I5: "That's where change needs to be started and needs to be advocated. So, since the beginning it has been clear that some places will still need to grow because they didn't achieve some infrastructure, such as public infrastructure and a certain living standard." I6: "I would never discuss degrowth or start the conversation in South-America, Africa or China. There is another way of framing the need to downscale our economy using other terminology. Degrowth in a certain context can be critized or attacked as: you're a white man living in the North and YOU need to degrowth. We still need to have our share of growth." RS2: "I mean it sounds great, but having to murder everyone in the global south that we have to tell "well you were this close, but now the white folks say no one can live that anymore, sorry" probably means it's kind of untenable." RS4: "The global poor would bear the burden of degrowth, it is very much a "fuck you, got mine" policy and philosophy." RS11: "This is a very dangerous ideology because there is an implicit "fuck you, I've got mine" built into this. The average global salary is equivalent to something like $10,000 per year. Average. So half of this planet live on less than that, and the bottom 10% live on something like $2 per day. If the trend of economic growth that has held roughly steady for the last 200 years continues, then by 2100 the average global salary will be equivalent to about $90,000 in today's dollars. Good! We need to keep going. If we can keep up the trend then in the lifetimes of children alive today, poverty will be eradicated worldwide. Even the bottom 10% would be what today we would call "lower middle class American". Even setting aside the in built racism of such an idea, we simply do not have the right to condemn two thirds of the people on this planet to inescapable poverty. Go to Zimbabwe and ask them what they think of "degrowth", while they bury their third child due to lack of safe drinking water." SiB p17: "The hope that the pursuit of goodness and virtue can be postponed until we have attained universal prosperity, and that by the single minded pursuit of wealth, without bothering our heeds about spiritual and moral questions we could establish peace on earth is an unrealistic, unscientific, and irrational hope." Escobar (2015): "First, it is important to resist falling into the trap, from northern perspectives, of thinking that while the North needs to degrow, the South needs 'development'; conversely, from southern perspectives, it is important to avoid the idea that degrowth is "ok for the North" but that the South needs rapid growth, whether to catch up with rich countries, satisfy the needs of the poor, or reduce inequalities; while acknowledging the need for real improvements in people's livelihoods, public services, and so forth, it is imperative for groups in the South to avoid endorsing growth as the basis for these improvements; a key criteria is that growth and the economy should be subordinated to BV and the rights of nature, not the other way around."

ID	Source : Excerpt
10	FGB: There may be a problem between the distinction. If you degrow ICT, then you limit the possibilities of degrowth by ICT. Belkhir & Elmeligi (2018): "The ICT industry has a rather positive image in the eyes of the sustainability community today as it has substantially transformed the way we communicate and work, uncovering opportunities to reduce the human impact on nature. As an example, e-commerce, tele-working, and video conferencing have reduced the worldwide travelling of both people and goods and hence the consumption of petroleum and the emission of greenhouse gases"
11	FGA: "The incremental nature of ict is a contribution to the problem. Generations of products create a continuous feedback loop of consumerism, people get stuck in this loop." FGC: "We can reduce ICT by supporting older devices as long as possible so consumers are not required to buy new computers. This artificially increases demand. Someone has to pay for that demand, it is not free." FGD: Degrowth can be applied in the sense that you develop ICT that is useful for a person but prevents overuse. Current systems are very bad for mental health as well. I4: "The stronger we have that image in our minds about this alternative society, the easier it will be for us to go towards it. The technology is a key element of course in creating that society. First, we have to imagine what life we want to have and what society we want to build. And then we have to wonder what the minimal technological help we need for it is. And again, that doesn't mean we have to restrain ourselves. The most important thing is, is that it is discussed how we want to live." I5: "The field of small or low tech is more like thinking of things that are just minimum viable for services." RSO: "Many people, including myself to some extent, have difficulties managing the time they spent using ICT in their lives" RSO: "I am sad to have to depend on it so much and would like to live with much less of it." RSO: "I use a computer all day for work. I would prefer to use it less, but I "need to". I also use it to read interesting content and make plans with friends. (I enjoy this form of use.) I look forward to a degrowth world where I can work less, spend more time gardening, and use ICT less." RSO: "Of course, the invention of the iPhone means that I spend more time online and much of my "social interaction" is online. This has had a negative impact" Pansera et al. (2019): "More concretely, the Degrowth community has determined that the technological development that propelled economic growth over the last two centuries is no longer socially and environmentally sustainable or desirable (Jackson, 2009; Kallis, Kerschner, & Martinez-Alier, 2012)."

ID	Source : Excerpt
12	FGB: It is impossible for many companies to let ICT out of the picture altogether. We should embrace what we have instead of limiting our usage of ICT because there are many ways to use ICT for good. FGC: Growth of ICT is essential to solving the problems we are facing, like using smart systems to reduce energy consumptions Pansera et al. (2019): "As we presently address scarcity by investing in more efficient technological systems, it is likely that the future will be characterised by a desperate quest for efficiency improvements. Automated decision-making enabled by ICT could play a central role. The problem is that "efficiency" is predominantly defined as a maximisation of input-output ratios, in particular of money, ignoring social and environmental costs." Hilty (2015): " However, ICT innovations could in principle support the transformation towards a sustainable economy. To use ICT for this purpose, we must strive for ICT applications that help us to escape the vicious circle of productivity and compulsory consumption. Such applications may look very different from the standard software and hardware we are buying today."
13	FGB: "ICT has almost unlimited capabilities of being efficient. Developing ICT would do more with less. " FGD: We should not limit ICT right now because it can bring more value to many sectors. I6: "The degrowth of ICT means that we are already relying on an infrastructural base of ICT, so cables, datacentres and other stuff of that. If you say that this needs to be stopped and reversed and at the same time you say that you need to apply ICT in another sector to allow other sectors to degrow and downscale, you have to combine these two things. On the one hand you need to slow down and downscale and on the other side you have to apply more ICT in order to facilitate degrowth. So it's a loop and there is a connection." SiB p148, Gandhi: "As Gandhi said, the poor of the world cannot be helped by mass production, only by production by the masses. The system of mars production, based on sophisticated, highly capital- intensive, high energy input dependent, and human labour-saving technology, presupposes that you are already rich, for a great deal of capital investment is needed to establish one single workplace. The technology of mass production is inherently violent, ecologically damaging, self-defeating in terms of non-renewable resources, and stultifying for the human person." Pansera et al. (2019): "athough there are many problems that have not been solved with productivity and big factories, we also have seen in a lot of alternative projects where ICT has been used to create decentralized, resource efficient solutions by using small computers and more adaptable devices. If we are able to increasingly put these technologies into the hands of people, and to avoid their control via big corporate giants, we might have a different future for digitalization"."
14	FGC: "Growth of ICT is essential to solving the problems we are facing. Using smart systems to reduce energy consumptions, and buying used goods is now easier." FGD: "Making things more efficient does also increase use of ICT" I2: "And then there is the trend of putting microchips in everything, which I find very absurd. Why does a fridge need a microchip? Why does it need to communicate with the internet? It sounds strange to some people, but wait another 15-20 years and everybody thinks it's normal." Pansera et al. (2019)

ID	Source : Excerpt
15	FGB: "Use ICT to replace 'inhumane' labor. For tough physical labour, use robots for instance." FGC: "When facebook and instagram went down for a day, people rather enjoyed it." I4: "One of the unwise futures is a totally, ICT-dominated, controlled world where everyone has some digital device and it tracks your entire life." RSO: "ICT puts us back in Plato's cave, where we view everything (social situations included) through a distorting lense. That lense doesn't have my own well being as its objective, to the contrary, so I avoid it." RSO: "I think it's a tool, which can be bad and can be good. It allows us to cut many sources of waste but also pulls us out of reality and our social environments. RSO: "Social media is making society dumber and angrier. Too many echo chambers and bad information." SiB p145, Pius IX: 'Bodily labour, which was decreed by Providence for the good of man's body and soul, even after original sin, has everywhere been changed into an instrument of strange perversion: for dead matter leaves the factory ennobled and transformed, where men are corrupted and degraded." Healy (2020): "A profound contradiction exists at the heart of our interaction with Information Communication Technology (ICT): it offers a myriad of possibilities to enrich our lives yet it habitually fails to deliver on its promises, leaving us grappling with profoundly negative experiences at global, national, local, organisational or personal levels" Marx (1970): "The externalisation of the worker in his product means not only that his labour becomes an object, an external existence, but that it exists outside him, independently of him and alien to him, and begins to confront him as an autonomous power; that the life which he has bestowed on the object confronts him as hostile and alien (Marx 1970b, 108)"

ID	Source : Excerpt
16	FGA: Degrowth and ICT do not work well together. ICT does not have well-being in mind. I4: "You quickly see what people don't want, for example a fragmented society caused by ICT, people living in isolation in a digital/virtual world, and also they don't want ICT to allow more social control. So, always first look at the way we want to live and the kind of society we want to have and then look what sort of minimal appropriate technology is needed to achieve it. " RSO: "No algorithms, collectively-owned networks, locally-based infrastructures and governance. Also, use ICT for well being and freeing people's time, not the opposite. I don't know if it fits, but if you invest as a supermarket owner into new tech for self scans (in a way, information tech), use this to reduce the working hours of your employees or their labour, not to reduce the number of employees." RSO: "efficiency is horrible and inhuman." RSO: "Stop forcing people to upgrade and throw things away" RSO: "Not-for-profit is the way. Redefine innovation, redefine growth. In a degrowth world, don't aim for vertical growth where you just become huge. Grow horizontally and let other people carry the ideas. An obvious addition is open-source code, open-source tech, non proprietary information, and community owned." RSO: "Most of the 'progress' in ICT is superficial or even calculated to inflict loss (create waste) on others. Contrast the perpetually revolutionary API changes Microsoft inflicts on developers, much of which is intentionally motivated to force systems upgrades, with the gradual iterative improvements in Linux. Look at how useless the UIs of major platforms like Youtube are simply because they need to manipulate people so they can serve more profitable advertising. Remove the profit out of ICT and systems will become less demanding, less intrusive, more effective and equipment will last much longer." RSO: "Outlaw, and punish severely, planned obsolescence. Make products easily repairable Make products as recyclable as possible." RSO: "Everything should be built to last and function as long as possible. there's no reason our devices can't be built to last twenty years, except greed for consumer dollars" SiB p146: "Karl Marx appears to have foreseen much of this when he wrote: 'They want production to be limited to useful things, but they forget that the production of too many useful things results in too many useless people.' to which we might add: particularly when the processes of production are joyless and boring. All this confirms our suspicion that modern technology, the way it has developed, is developing, and promises further to develop, is showing an increasingly inhuman face, and that we might do well to take stock and reconsider our goals." Pansera et al. (2019): "" I think what emerged in the group discussion is that people mainly fear 'disconnection'. Detachment from nature and people, this is what people in the Degrowth community are afraid of, particularly given the level of disconnection from the rest of nature and from each other that human societies, mostly in the industrialised world, have already reached. This is also exemplified by the illusion of social interaction via virtual social relationships."" Illich & Lang (1971): Such a society, in which modem technologies serve politically interrelated individuals rather than managers, I will call " convivial"

ID	Source : Excerpt
17	I5: "So I guess people are starting to see that those changes are not far in the future and those effects of high growth and high material and energy use of our society, even if it's not explained in that way, are perceived and are clear and hard to deny." & "And some would consider that maybe we need to be more sustainable, more resilient. And then that's where a degrowth strategic education or strategic influence can come, because people are far enough to see that we need to change, but they don't have access to cultural influences that will bring in the spectrum of their potential ideology, the idea that reduction, contraction, deliberate, steady-state is an option and is relevant." RS2: "Degrowth is a necessity, we are literally working the planet to death." RS2: "Personally am a strong advocate for Degrowth; humanity is in full overshoot of all planetary ecosystems and consuming all remaining resources at an ever-accelerating pace" RS12: "In general, I view continued growth as a type of cancer. No healthy system should be able to grow indefinitely, a point of either stasis, regeneration or deceleration/death should occur." RSO: "It needs to be done, too many people and not enough resources." LiM p110: "The results were striking. The business-as-usual scenario, with economic growth continuing at its normal rate, showed that sometime between 2030 and 2040 we would run into a crisis. Driven by the compound nature of the growth function, renewable resources would begin to reach the limits of their renewability, non-renewable resources would begin running out, and pollution would begin to exceed the capacity of the Earth to absorb it. " Pansera et al. (2019): "In a nutshell, the Degrowth community challenges socio-technological imaginaries like those symbolised by flying cars on the basis of real needs for a 'good life', considering the broader social, ecological and personal benefits of simple life-styles in the context of biophysical limits on both resources and sinks (i.e. the capacity of ecosystems to absorb the waste-products of human activity, such as CO2)." Rockstrom et al. (2009), Steffen et al. (2015)

ID	Source : Excerpt
18	FGB: "Environmental change is not directly affecting the people making the decisions. Long-term yes, but short-term change is not visible. Changes will not be made even if radical situations occur (think of the pandemic)." FGC: Solutions that we have right now are fake and focused on greenwashing while maintaining endless growth. I5: "So, there are big changes that can be done but we shouldn't forget that those reduction are mostly state-wide reduction. So it means that what you can reduce as an individual is, let's say, 25% of your energy impact. The rest of the 75% are things that are nation-wide, such as infrastructure, schools, hospital, shipping system, the heating of the buildings, and so on. All those things, even if you do all the proper vegan, degrowth, and ecological consciousness, you cannot change that other 75% percent. And that's where Western nations have to make the biggest effort and at a larger social level." LiM p129: "A new consensus has emerged. While for decades we have been relying on market mechanisms to somehow magically fix the climate crisis, it's now clear this approach isn't going to do. The only way to make it work is with co-ordinated government action on a massive scale. Proponents of the Green New Deal have it right: we need to pump public investment into building renewable energy infrastructure at a historically unprecedented rate, reminiscent of the industrial retooling that enabled the Allies to win the Second World War." SiB p152: "In one way or another everybody will have to take sides in this great conflict. To 'leave it to the experts' means to side with the people of the forward stampede. It is widely accepted that politics is too important a matter to be left to experts. Today, the main content of politics is economics, and the main content of economics is technology. If politics cannot be left to the experts, neither can economics and technology." UNDP Climate Vote: "Even though the survey was conducted during the COVID-19 crisis, there was still widespread recognition of climate change as a global emergency in every country surveyed. Over all 50 countries, 64% of people said that climate change was an emergency – presenting a clear and convincing call for decision-makers to step up on ambition."

ID	Source : Excerpt
19	FGB: "I agree that resources are limited, and it is a big problem that we consume them too fast. " FGC: "We should focus on consumerism and the fact companies are focused on pushing products to market, and marketing new things. Companies do this because they have to make money in the end. If they do not make more money, they lose money because of inflation." RS2: "What about doing away with the concept of planned obsolescence? Much of our consumerism is based on goods being cheaply made in enormous quantities, bought and thrown out as soon as fashion changes. Fast fashion is incredibly wasteful. Disposable products should be limited to medical necessity. A shift in priorities, the kind we're facing with the breakdown in global change, is going to push us in that direction anyways." RS2: "The world is too unbalanced and consumption is out of control" "Personally am a strong advocate for Degrowth; humanity is in full overshoot of all planetary ecosystems and consuming all remaining resources at an ever-accelerating pace" RS4: "It would be easier if we dealt with consumerism culture." RS12: "I think it's important. We need to slow down, consume less, stop the hustle." RS12: "Well, I don't necessarily believe in degrowth. But consumer minimalism. I think there is in fact lots of things to spend money on like science, charity. But in my own life I educate myself to buy only what I need and what is useful" RS12: "Yes please. Our consumer culture is entirely unsustainable. I was just thinking about this. I used to enjoy shopping (still do, but even more second-hand items than I bought before). I stopped in one of those home decorating stores today after a dr appt, and my mindset is just entirely changed. It's so unsustainable to have giant box stores full of new items every season or every week. Almost all of it will just end up in a landfill one day. It's atrocious, and I don't want to continue living like this." RSO: "I do agree with it as I think that in first world countries especially, the average citizen possesses many items that aren't necessarily essential to their life and may not even be used very often" RSO: "We waste far too many resources and are destroying the planet because of induced, unnecessary consumption." RSO: "A reduction... I agree, the north should stop wasting resources on the south and it should also stop trade, thievery, and interference in the south. It should also slow much of it's production and consumption while working towards degrowth and sustainability." RSO: "To attain degrowth will require a reduction of global consumption and population reduction, both north and south."

ID	Source : Excerpt
20	FGC: Noone expects poor countries to degrow, people who have no clean water cannot expect to stop growing. We should stop growing instead. I3: "And we, people from the West, should acknowledge this aspect and try to find alternatives that would address economic inequality and ecological breakdown and the same time." I5: "From early on, degrowth writers and movements have been clear that degrowth means, first of all degrowing the wealthy nations and the nations that consume much more than necessary for the basic living needs and that's where change can be done in a significant order of magnitude." RS4: "The global poor would bear the burden of degrowth, it is very much a "fuck you, got mine" policy and philosophy." Rich nations. Particularly the US and Europe, as well as China. In an ideal world, the wealthy and the government should take responsibility for solving climate change but as we've seen in recent years, the future only looks bleaker so I belive now the people of all nations need to rally together in order to urge the governments and the wealthy to contribute more into prevent irreversible climate change To summarize, within Europe: everyone, and in particular the wealthy, the corporations, and the politicians. In the world: The largest economies, with an accent on colonial nations Everyone. I was inclined to answer that the people who are mostly causing it, such as rich countries, should take the brunt of the effort, but realistically it requires a coordinated effort from the entire world. I don't know if you've ever tried to run a project with more than like 4 participants, but I'm not hopeful. LiM p99: "But there's something wrong with this picture. The language I've been using here – the language of 'we' – isn't quite accurate. Even when we accept that capitalism is driving ecological breakdown, we have a tendency to describe it in collective terms, as if all humans are equally responsible. The ideology of the Anthropocene has a way of worming its way back into our discourse. But this assumption blinds us to what's really going on. The word 'Anthropocene' is wrong not just because previous economic systems did not pose a threat to global ecology in the way that capitalism does today. It's also that even today not all people are equally responsible. " Philip Alston: "Climate change is, among other things, an unconsciable assault on the poor"
21	FGC: "Not exactly realistic for the global population to focus on degrowth. We first have to focus on enabling people to sustaining themselves." RSO: "I think ICT could be better used in helping to evenly distribute resources rather than helping a single nation gather it all for themselves and can be better used by the people rather than corporations, take farming for example, mabye some kind of technological improvement can be made to farms in order to increase crop yield in smaller areas to help feed a country rather than relying on other countries that ship food on fossil fuel guzzling cargo ships"

ID	Source : Excerpt
22	I2: "They all follow the same logic and they can proof whatever they want by saying "okay, you can easily produce all the energy with atomic power plants and we can keep on growing"," I3: "We have no empirical evidence that green growth has been manifested everywhere in the world. Now, many people believe that green growth is possible and bring the Nordic countries as examples. Many people are unaware how this argument is formulated, so on which basis do we celebrate Denmark as the green Mecca. Denmark produces the energy they use through renewables, but we don't take in consideration what is the real ecological footprint of a windturbine" RS12: "Governments and companies need to stop endorsing "green" or "nature-based" solutions/products that will continue to destroy the earth in other ways and instead look towards local, indigenous communities to find truly sustainable agricultural practices." RS12: "Degrowth is the only way forward in my opinion, but that will not be the case for the general public. The powers that be fought climate change for so long, but now they've gone and switched their war to redefining climate change etc as a carbon problem.I fear that 'net-zero' and offsets will allow them to continue business as normal - with people and nature still suffering, but it's okay because they will restore a wetland somewhere (which in ten years time may well be a new development, so that company will restore something else, and so on). There's really no such thing as sustainable consumption and development. Certainly not in the ways that the powers that be and the UN talk about it." RSO: "Reduction of consumption should be prioritized over technological innovation" RSO: "I do not believe it should be the main focus, I believe reduction of consumption should be the main focus, as well as actually fully utilizing the current set of technologies that we have. Banking on technological innovation is like telling people to smoke and not worry about cancer because surely doctors will find a solution to that in twenty years. We cannot predict the future, so betting on that going our way in a very favourable way is very naive in my opinion." LiM p126: The claim is that transitioning to clean energy will liberate capitalism from any concerns about ecology. Yale Poll: "The study polled over 2,047 registered voters in the United States between Sep. 30 and Oct. 1, 2020 and found that 82 percent of the voters polled "say achieving 100% clean energy should be the primary goal of U.S. Energy policy," according to a statement released by the YPCCC."
23	LiM p90: "Some credit this aggressive energy for the rapid innovation that characterises capitalism. Certainly there is truth to that" Schumpeter & Backhaus (2003): "We have seen that, similarly, innovations insofar as they are of practical importance to the economy, do not initiate economic development but, rather, are a consequence of economic development. These innovations occur whenever the entrepreneur needs them, and if it were not the case that an entrepreneur, in his particular role as an entrepreneur, would already be waiting in order to use any new invention, then these innovations would never be realized in practice. It is not the innovations that have created capitalism, but capitalism that has created the innovations needed for its existence."
24	FGB: "Moores law, processors doubling every year. How would this law have developed if we stopped releasing phones every month?"

ID	Source : Excerpt
25	FGA: "More gradual, if radical then people oppose it. Imposing radical change would not work on big companies" FGA: "Radical change could attract a lot of opposition, both people and big companies" FGB: Radical change is best kind fo change, but often not feasible. If you make a radical change in one aspect, then other areas will be affected, maybe negatively. FGB: "One small gradual change does nothing much. But do people accept radical change?" FGC: "Radical change is gonna produce more suffering in the end. People will like it less, and reduce likelihood of further change." FGD: "People might be opposed to radical ideas and disagree. On environmental issues it might be necessary, but people will still oppose it. People are scared of radical change." RS2: "Speed matters, going downstairs may be healthier than jumping through the window. But, of course, that enough global population (specially the ones with more economic power/consumption) collaborate with this may be an unrealistic expectation."
26	I1: "The author (lakoff) has written about political language and he says if you use certain terms, it does not matter what you say or how you charge the terms, if you use the wrong terms then you lose before you start to discuss." I2: I think both degrowth and low tech are useful terms in the sense that they are controversial or obviously the opposite of eternal growth and high-tech, I3: "The concept in itself, the branding of the concept is that to say, it may work in some regions of the world, it may not work in other regions of the world, because it is very cultural after all. As you said, mainly in the States, when they hear the term degrowth, they think they will return to the bucolic life on the mountains, which can be very uncivilised like back to the tribal societies." I4: "Then there are people who have heard about it but wouldn't want to use it because they think it's too radical. Some EU parliamentarians might be in that category, sympathetic with the main ideas but then they often bring forward milder versions, such as post-growth and these milder sounding concepts of beyond growth." I5: "And indeed that kind of works in the sense that if you think about sustainable development or growth, those things are being totally washed out of their content and they have been totally absorbed by the brain-washing capitalist interests. If you think about degrowth, it's been shaped in such a way that is a bit harder to turn it upside down or make it say the opposite of what it means. So, that's a strong quality." I6: "I think it's a good slogan to be used as a disruptive and provocative way of critizing the way our society is constructed, at least in the North"
27	FGB: "There is too much technological innovation for consumers. Right now we make 'new' tech every month with barely new features" FGD: " There is an IT component in almost all aspects of a production chain. " I2: It's [ICT] basically where everything happens. I mean if you look at what innovations are new in the last few decades, they are almost all in ICT and it's changing our world profoundly. RSO: "This innovation I would not say is directly relevant to ICT, but of course ICT is involved in probably every company at this point, so there is some tangential relation." Pansera et al. (2019): "Most of the last 50 years' technological advances, Graeber claims, were in simulation technologies based on information and communication technology (ICT)."

ID	Source : Excerpt
28	I1: I would say that the majority of them think that green growth and efficiency and, you know, electric cars and whatever is, that is their idea of sustainability. RSO: "Technological innovation has already down incredible things to address climate change, and will continue as the cost of solar cells plummet and battery technology advances" RSO: "The thing is about innovation is that it takes time for ideas to be conceptualised and then even longer for it to be accepted and put into action, while I believe that innovation can be a massive help in the fight against climate change, a reduction of consumption gives innovation a chance to catch up. A reduction in consumption is only good as it can reduce emissions which only expands the climates lifespan providing us with more item to implement green energy alternatives" RSO: "But I have seen some new gadgets cropping up that might help in the fight against climate change and it does give me some hope for the future" SiB p151: "There are no insoluble problems. The slogans of the people of the forward stampede burst into the newspaper headlines every day with the message, 'a breakthrough a day keeps the crisis at bay'."
29	I2: those are really small advances in comfort. I mean, in the 20th century, that were like "wow", for example the car, train, television, radio. But a fridge that communicates with the internet, it's not something that changes daily life in a very meaningful way. RSO: "Hard to say, perhaps bluetooth headphones, lightweight materials, induction plates, better antihistamines and some other conviences, but nothing groundbreaking I believe."
30	RS2: "At least until everything else catches up and we can support more people and growth with better technology" RS4: "Infinite economic growth" should also not really be a big problem as long as technological progress is possible and I think we're very far from reaching a limit on that front." RS12: "One of at forward would be to use innovation to deliver more benefit whilst using less stuff/energy." RSO: "Technological innovation is essential to avoid catastrophic climate change and will likely be the main force in preventing it." SiB p151: "There are no insoluble problems. The slogans of the people of the forward stampede burst into the newspaper headlines every day with the message, 'a breakthrough a day keeps the crisis at bay'."

ID	Source : Excerpt
31	FGB: "The idea of degrowth sounds good in theory, but how will it work in practice?" FGB: "How do you degrow? If you are the only one degrowing then it has no effect?" I3: "But maybe there are also other preconceptions even from people that understand that degrowth is against growing the GDP, they have been nurtured that a roaring GDP means wealth and happiness." I4: "To be honest, a lot of people, including myself, got quite bold about this discussion, but then it became clear again that it is still some really important and relevant discussion to hold because the idea of decoupling, is one that needs to be respected because it gives something that people who are desperate for change are clinging onto. People hold on to it because they don't believe the human society can actually change. So that makes you quite desperate I guess and attached more to technological changes. I think we need to very carefully dismantle this idea and also give some people hope." I5: "It is bending towards specific values and a specific framework to understand the world and make decisions. And the way most of the media and common culture shapes us is towards valuation of growth, expansion, acceleration. I mean, our systems reward people who travel more, go to bigger cities, do more, own more. So it's a matter of a deep core value system, which is very hard to challenge." & "To make the answer short: I think that our social software and our political software are not very shaped to be able to embrace, understand and value anything that relates to a contraction, degrowth, throwdown. It's not a part of our social software." & "So it's hard to think in the opposite direction with the software that is built, let's say, for growth." & "I think it's a human or animal bias in the sense that, if there is something which is the only way we know from history, it's very hard to see reasons why we have to get ready for something else or for something totally opposite." I6: "No, I'm just saying that ecomodernism is common sense. In every society in history, there is a common sense, so principles and ideas that people take for granted. And growth and the idea that technology is going to solve all the problems, is some of the common senses of our time. But this was socio-economically constructed. Before the World War 2, this was not the case. So it's not a battle of ideas of degrowth and eco-modernism. Eco-modernist ideas are taken for granted for the vast majority of people, business people, universities, academics. It's there and it's not questioned. It's not even considered as a way of solving problems, it is THE way. There is no serious battle between two positions. There is one hegomonic idea and there are other counter-hegomonic ideas that try to make cracks and fracture in the common sense. I hope that's clear" Pansera et al. (2019): "Streeck (2016) observes that while capitalism is now obviously undergoing a drastic transformation, we are unable to imagine what will come afterwards."

ID	Source : Excerpt
32	I4: "It's always something that needs to be clarified that degrowth is about a good life with less, right. That a lot of things don't work now, we're not a very happy society and also globally seen it is not justified." RS2: "I've personally been simplifying my life in some really extreme ways for awhile now. Degrowthing my life, if you will. I've been able to find a lot of joy in it, but it can also be quite lonely at times since most people aren't interested in going to the same extremes." RS12: "But in my own life I educate myself to buy only what I need and what is useful." RSO: "Yes. Healthy food and shelter and community is what I need. Ideally a community who is in touch with its ecosystem (almost impossible to find in industrialized countries like the US)" RSO: "I believe so. I believe a good life is a life where basic needs are met, where we have opportunities for self-development, where we can contribute to society, where we can enjoy our natural environments. Materially, I do not believe people really need that much; most consumption can be avoided by not offering it to anyone in the first place. But if one group of people gets to enjoy certain privileges, that leads to envy and then others wish to enjoy those privileges as well." RSO: "YES! I need access to food, clean water, clean air, sleep, shelter from cold/heat/rain, protection from violence. For my happiness, I also need a fun supportive community and new sneakers (I love to run, and I replace my sneakers after 1300 km because it's best for your feet)" RSO: "Yes, possibly a better life. An uncrowded community free from the influence of outsiders, land to raise/grow my own food, the freedom to visit other communities, a small home, clean water, nearby wild spaces, the ability to compete for the best partner, resources, etc... Some form of entertainment" RSO: "yes already do. a small affordable house no bigger than 1600 sq ft. energy efficient appliances and lights." RSO: "yes, we've cut back a lot on purpose and are living what I consider a good life. food, dirt for a garden, access to the outdoors, shelter, warmth/cooling, appropriate clothing for the temp, some form of entertainment (doesn't need to be high tech or intense, a book or music is good). the ability to connect with friends or family. purposeful and useful work." Escobar (2015): "As DG advocates well put it, DG is not about doing "less of the same" but about living with less and differently, about downscaling while fostering the flourishing of life in other terms (Kallis et al. 2015)." Latouche (2014): "As the growth society has failed to deliver its promise of universal happiness, we have to find out what such a promise actually meants. Overconsumption of material goods condemns a frowing part of the population to deprivation, without even ensuring that the rest enjoy a high quality of life. The clean beark proposed by the degrowth initiative consists of redefining happiness as a 'frugal abundance in a society based on solidarity'. It implies escaping from the vicious circle of unlimited creation of new products and needs, as well as from the growing frustration that this generates." Steinberger & Roberts (2010) : ""If resources were equally distributed, current energy and carbon levels would be more than sufficient to satisfy global human needs at high levels of human development. Heinrich Böll: "Live simply so that others may simply live."

ID	Source : Excerpt
33	FGA: "instead of 'a light', you buy 'light'" RS12: "Instead of owning dozens of books you could just as well use the library." RSO: "And as the Global South continues to develop, promote shared ICT versus privately-owned individual computers" Havas Poll: "A large majority of those surveyed in 29 markets believe that over-consumption is actually putting our planet and society at risk. Most say they could happily live without most of the items they own and that they make it a point to rid themselves of unneeded possessions at least once a year. We have entered an age when sharing, rather than buying, everything from cars and vacation homes to textbooks and pets has become socially acceptable among those who realize we have exhausted the planet and ourselves with way too much stuff and responsibility." (Havas Global Comms, 2014)

F Q-sort factor visualizations

Figure 17: Persona of Q-sort factor 1 (Environmentalist).

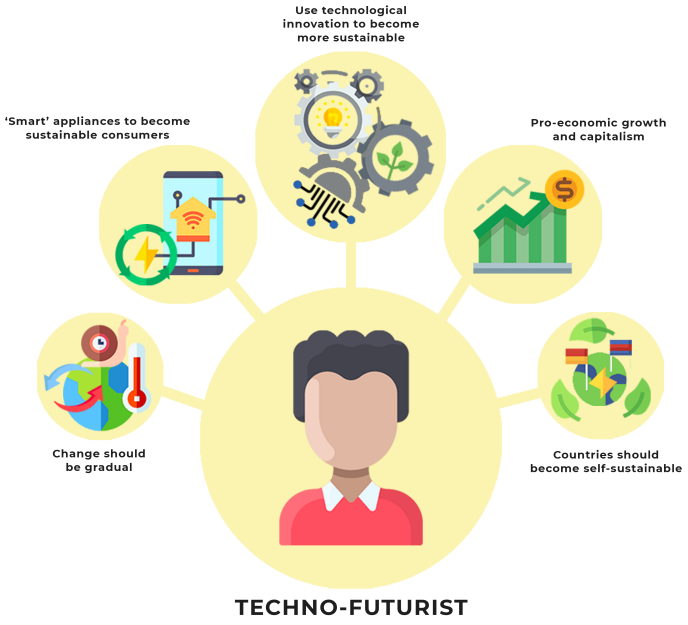

Figure 18: Persona of Q-sort factor 2 (Techno-Futurist).

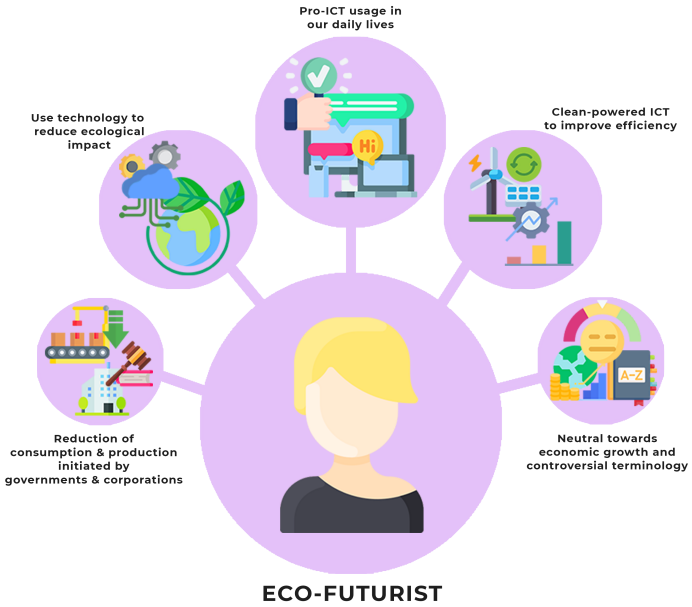

Figure 19: Persona of Q-sort factor 3 (Eco-Futurist).

Figure 20: Persona of Q-sort factor 4 (ICT Advocate).

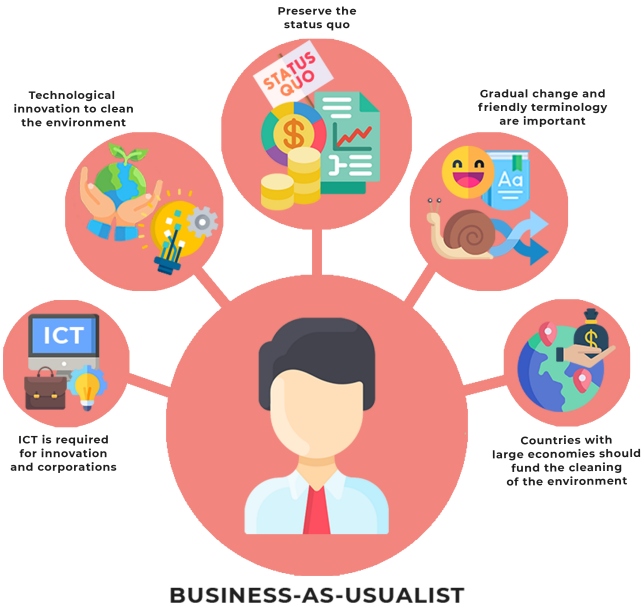

Figure 21: Persona of Q-sort factor 5 (Business-as-usualist).

Figure 22: Persona of Q-sort factor 6 (Green growther).

G Mapping Study Results

The following pages contain the selected papers and their assigned values. The papers marked (red in the spreadsheet) have been discarded from the mapping study as stated in section 6.

Table 10: Papers found in the literature search

ID	Paper
1	Abbing (2021)
2	Discarded: not a research publication
3	Bonaiuti (2018)
4	Chen (2016), Discarded: does not mention degrowth
5	de Valk (2021)
6	Drews & van den Bergh (2016), Discarded: does not concern ICT
7	Edwards & Espelt (2020)
8	Discarded: not a research publication
9	Garcia et al. (2018)
10	Haucke (2018)
11	Heikkurinen (2018)
12	Howson (2021)
13	Ibrahim & Sarkis (2020)
14	Kallis et al. (2018)
15	Kerschner et al. (2018)
16	Kirchherr et al. (2017), Discarded: does not mention degrowth or concern ICT
17	Kostakis et al. (2018)
18	Discarded: duplicate of paper 17.
19	Likavčan & Scholz-Wäckerle (2018)
20	Macgilchrist (2021)
21	March (2018)
22	Navarro-Remesal (2019), Discarded: does not concern ICT
23	Pansera et al. (2019)
24	Pérez-García (2021)
25	Pollex & Lenschow (2018)
26	Pueyo (2018)
27	Puglia et al. (2014)
28	Pyakurel (2021)
29	Raghavan & Pargman (2017)
30	Balaguer Rasillo (2021)
31	Rossi (2016)
32	Samerski (2018)
33	Lange et al. (2020)
34	Welfens et al. (2013), Discarded: does not mention degrowth
35	Temmerman & Van den Broeck (2021)
36	Vitari (2014)
37	Westermayer (2014)
38	Widdicks et al. (2018)
39	Zoellick & Bisht (2018)

Identifier	Authors	Title	Year	Published in
1	Abbing	‘This is a solar-powered website, which means it sometimes goes offline	2021	Seventh Workshop on Computing within Limits
3	Bonauiti	Are we entering the age of involuntary degrowth? Promethean technolog	2018	Journal of Cleaner Production
5	de Valk	A pluriverse of local worlds: A review of Computing within Limits related t	2021	Seventh Workshop on Computing within Limits
7	Edwards & Espelt	Technology for degrowth: Implementing digital platforms for community s	2020	Food for Degrowth
9	Garcia, Jeronimo, & Carval	Methodological Luddism: A concept for tying degrowth to the assessmer	2018	Journal of Cleaner Production
10	Haucke	Smartphone-enabled social change: Evidence from the Fairphone case?	2018	Journal of Cleaner Production
11	Heikkurinen	Degrowth by means of technology? A treatise for an ethos of releasemer	2016	Journal of Cleaner Production
12	Howson	Distributed degrowth technology: Challenges for blockchain beyond the	2021	Ecological Economics
13	Ibrahim & Sarkis	Technological Innovations and Degrowth Opportunities From Urban Egy	2020	Frontiers in Sustainable Cities
14	Kallis et al. (303-306)	Research On Degrowth	2018	Annual Review of Environment and Resources
15	Kerschner et al.	Degrowth and Technology: Towards feasible, viable, appropriate and cor	2018	Journal of Cleaner Production
17	Kostakis, Latoufis, Liarokap	The convergence of digital commons with local manufacturing from a de	2016	Journal of Cleaner Production
19	Likavčan, Scholz-Wäckerle	Technology appropriation in a de-growing economy	2018	Journal of Cleaner Production
20	Macgilchrist	Rewilding technology	2021	on_education
21	March	The Smart City and other ICT-led techno-imaginaries: Any room for dialogue w	2018	Journal of Cleaner Production
23	Pansera, Ehrichs, Kerschn	Unlocking wise digital techno-futures: Contributions from the Degrowth c	2019	Futures
24	Pérez-Garcia	The ICT-Buen Vivir Paradox: Using Digital Tools to Defend Indigenous C	2021	1st Virtual Conference on Implications of Informatior
25	Pollex, Lenschow	Surrendering to growth? The European Union's goals for research and t	2018	Journal of Cleaner Production
26	Pueyo	Growth, degrowth, and the challenge of artificial superintelligence	2018	Journal of Cleaner Production
27	Puglia, Ficarola, A. Leoni, L	The “Open Altra Economia” (OAE) project: Open Data and Open Source	2014	Degrowth Conference Leipzig, 2014
28	Pyakurel	Green growth or degrowth? Evaluating the potential of technology for su	2021	Economics and Policy of Energy and the Environme
29	Raghavan, Parman	Means and Ends in Human-Computer Interaction: Sustainability through	2017	CHI Conference on Human Factors in Computing Sy
30	Rasillo	Alternative economies, digital innovation and commoning in grassroots c	2020	Environmental Policy and Governance
31	Rossi	Framing the Privacy Debate and Big Data Governmentality in Degrowth	2016	5th International Degrowth Conference in Budapest
32	Samerski	Tools for degrowth? Ivan Illich's critique of technology revisited	2016	Journal of Cleaner Production
33	Lange, Pohl, Santarius	Digitalization and energy consumption. Does ICT reduce energy demanc	2020	Ecological Economics
35	Temmerman, van den Broe	The Decolonisation of the Smart City through Degrowth and Serendipity	2021	IEEE International Smart Cities Conference (ISC2),
36	Vitari	Electronic currencies for purposive degrowth	2014	HAL (Unpublished?)
37	Westermayer	Information technology, decoupling and networked commons - a concep	2014	Degrowth Conference Leipzig, 2014
38	Widdicks, Ringenson, Parg	Undesigning the Internet: An exploratory study of reducing everyday Inte	2018	5th International Conference on Information and Cor
39	Zoellick, Bisht	It's not (all) about efficiency: Powering and organizing technology from a	2017	Journal of Cleaner Production
*	Chen	A strategy for limits-aware computing	2016	Seventh Workshop on Computing within Limits

			Relational focus		Types of degrowth						Valence		Green growth	
Identifier	Authors	Authors' countries of affiliation	DoICT	DbICT	GDP	Consumption	Work-Time	Radical	Physical	Agrowth	+	-	+	-
1	Abbing	Sweden	1	0	0	1	0	0	1	0	1	0	0	0
3	Bonauiti	Italy	0	0	0	0	0	0	1	0	1	0	0	0
5	de Valk	UK	1	0	0	1	0	0	0	0	1	0	0	1
7	Edwards & Espelt	Spain, Norway	1	1	0	1	0	0	1	0	1	0	0	0
9	Garcia, Jeronimo, & Carval	Portugal, Portugal, Portugal	1	0	0	1	0	1	1	0	1	0	0	0
10	Haucke	Germany	1	0	0	1	0	0	1	0	1	0	1	1
11	Heikkurinen	UK	1	0	0	1	0	1	1	0	1	0	0	1
12	Howson	UK	0	1	0	0	0	1	0	0	0	0	0	1
13	Ibrahim & Sarkis	Egypt, USA	1	1	0	1	0	1	1	0	1	0	1	1
14	Kallis et al. (303-306)	Spain, Estonia & USA, Germany, USA, USA, Germany	0	1	0	1	1	1	1	1	1	0	0	1
15	Kerschner et al.	Czech Republic & Austria, Austria, Germany, Germany	1	1	0	1	0	0	1	0	1	0	0	1
17	Kostakis, Latoufis, Liarokap	Estonia, Greece, USA, The Netherlands	0	1	0	1	0	1	1	0	1	0	0	0
19	Likavčan, Scholz-Wäckerle	Czechia, Austria	1	1	0	0	0	1	0	1	1	0	0	0
20	Macgilchrist	Germany	1	0	1	1	0	1	1	0	1	0	0	1
21	March	Spain	1	1	0	1	0	1	0	0	1	0	0	1
23	Pansera, Ehrichs, Kerschn	UK, Germany, Austria	1	1	0	1	0	0	1	0	1	0	0	1
24	Pérez-Garcia	Belgium	0	1	0	0	0	1	0	0	1	0	0	0
25	Pollex, Lenschow	Germany, Germany	0	0	0	0	0	0	0	0	0	0	1	1
26	Pueyo	Spain	1	0	0	0	0	1	0	0	1	0	1	1
27	Puglia, Ficarola, A. Leoni, I	Italy, Italy, Italy, Italy, Italy	0	1	1	1	0	1	0	0	1	0	0	0
28	Pyakurel	UK	0	1	0	1	0	1	0	0	1	1	1	1
29	Raghavan, Parman	USA, Sweden	1	0	1	1	0	0	0	1	1	0	0	1
30	Rasillo	Switzerland	0	1	1	0	0	1	1	1	1	1	0	0
31	Rossi	France	1	0	0	0	0	1	0	0	1	0	0	1
32	Samerski	Germany	1	0	0	1	0	1	1	0	1	0	0	1
33	Lange, Pohl, Santarius	Germany, Germany, Germany	1	0	0	1	0	0	1	0	1	0	1	1
35	Temmerman, van den Broe	Belgium, Belgium	1	0	0	0	0	1	0	0	1	0	0	1
36	Vitari	France	0	1	1	0	0	1	0	1	1	0	0	0
37	Westermayer	Germany	0	1	0	0	0	1	1	0	1	0	0	1
38	Widdicks, Ringenson, Parg	UK, Sweden, Sweden, Germany, the Netherlands	1	0	0	1	0	0	0	0	1	0	0	1
39	Zoellick, Bisht	Germany, India	0	1	0	1	0	1	1	0	1	0	0	1
*	Chen	USA	0	1	0	1	0	1	1	0	1	0	0	1
		Total number of occurences	19	16	5	20	1	20	17	5	29	2	6	21

		Conviviality		Type of Change		Scope of change					Transition			Change initiator	
Identifier	Authors	+	-	Gradual	Radical	Intrapersonal	Interpersonal	Institutional	Systemic	Cultural	As-Is	To-Be	Intermediates	Top-down	Bottom-up
1	Abbing	0	0	0	1	0	0	1	1	0	1	1	1	1	0
3	Bonauiti	0	0	1	0	0	0	0	1	0	1	0	1	0	0
5	de Valk	1	0	1	0	0	0	0	1	1	1	1	0	0	1
7	Edwards & Espelt	1	0	0	1	1	1	1	0	0	1	1	0	0	1
9	Garcia, Jeronimo, & Carval	1	0	0	1	0	1	0	1	0	1	1	0	0	1
10	Haucke	0	0	1	0	1	0	1	1	0	1	1	0	1	1
11	Heikkurinen	1	0	0	1	0	0	0	1	0	1	1	1	0	1
12	Howson	0	0	1	0	0	0	1	0	0	1	1	0	1	0
13	Ibrahim & Sarkis	1	0	1	0	0	0	0	1	1	1	1	0	1	1
14	Kallis et al. (303-306)	1	0	0	1	0	0	0	1	0	1	1	1	0	1
15	Kerschner et al.	1	0	0	1	0	0	0	1	0	1	1	0	0	1
17	Kostakis, Latoufis, Liarokap	1	0	1	0	0	1	0	1	0	1	1	0	0	1
19	Likavčan, Scholz-Wäckerle	1	0	0	1	0	0	0	1	1	1	1	0	0	0
20	Macgilchrist	1	0	1	0	0	1	1	0	0	1	1	1	1	1
21	March	1	0	1	0	0	0	0	1	1	1	1	1	1	1
23	Pansera, Ehrichs, Kerschn	1	0	0	1	0	0	0	1	1	0	1	1	0	1
24	Pérez-Garcia	1	0	1	0	0	0	0	0	1	1	1	1	1	1
25	Pollex, Lenschow	0	0	1	0	0	0	0	1	0	1	1	0	1	0
26	Pueyo	0	0	0	1	0	0	1	0	0	1	1	0	1	0
27	Puglia, Ficarola, A. Leoni, L	1	0	1	0	0	0	0	1	1	0	1	1	0	1
28	Pyakurel	0	0	1	0	0	0	0	1	0	1	1	0	0	0
29	Raghavan, Parman	1	0	1	0	0	0	0	1	0	1	1	0	1	0
30	Rasillo	1	0	0	1	0	0	0	1	1	1	1	1	0	1
31	Rossi	1	0	1	0	0	0	0	1	1	1	1	0	1	1
32	Samerski	1	0	0	1	0	0	0	1	1	1	0	0	0	1
33	Lange, Pohl, Santarius	0	0	1	0	0	0	0	1	0	1	1	0	1	0
35	Temmerman, van den Broe	1	0	1	0	0	0	0	1	1	1	1	1	1	1
36	Vitari	0	0	0	1	0	0	0	0	1	1	1	0	0	0
37	Westermayer	0	0	1	0	0	0	0	1	1	1	1	0	0	1
38	Widdicks, Ringenson, Parg	0	0	1	0	1	1	0	0	1	1	1	1	1	1
39	Zoellick, Bisht	1	0	1	1	0	0	0	1	0	1	1	1	0	0
*	Chen	0	0	1	0	0	0	0	1	0	1	1	1	0	0
		20	0	19	13	3	5	6	24	14	29	29	13	14	20

		Side effects	Rebound effects	Ownership		Affected Industries		Geographical Scope				Level of Technology	
Identifier	Authors			Private	Commons	Sector (NACE lv1)	Generic	Local	National	International	Global	Low-tech	High-tech
1	Abbing	0	1	1	0	J: Information and Communicat	0	1	0	0	1	1	0
3	Bonauiti	1	0	1	0	J: Information and Communicat	0	0	0	1	0	0	1
5	de Valk	0	1	0	1	J: Information and Communicat	0	1	0	0	1	1	0
7	Edwards & Espelt	0	0	1	1	A: Agriculture; Forestry and Fis	0	1	1	0	0	1	1
9	Garcia, Jeronimo, & Carval	0	1	0	0	NA	1	0	0	0	1	0	1
10	Haucke	0	1	1	0	J: Information and Communicat	0	0	0	1	0	0	1
11	Heikkurinen	1	1	0	0	NA	1	0	0	0	1	0	1
12	Howson	0	0	1	1	J: Information and Communicat	0	1	1	0	1	0	1
13	Ibrahim & Sarkis	0	1	1	0	NA	1	1	0	0	1	1	1
14	Kallis et al. (303-306)	1	1	0	1	NA	1	1	0	0	1	1	1
15	Kerschner et al.	1	1	0	0	NA	1	0	0	0	1	1	1
17	Kostakis, Latoufis, Liarokap	0	0	0	1	NA	1	1	0	0	1	1	1
19	Likavčan, Scholz-Wäckerle	1	0	0	1	J: Information and Communicat	0	0	0	0	1	0	1
20	Macgilchrist	0	1	1	0	P: Education	0	1	0	1	0	1	1
21	March	0	0	0	1	J: Information and Communicat	0	1	0	0	0	0	1
23	Pansera, Ehrichs, Kerschn	0	1	0	1	NA	1	0	0	0	1	0	1
24	Pérez-Garcia	0	0	0	0	J: Information and Communicat	0	0	0	1	0	0	1
25	Pollex, Lenschow	1	0	0	0	U: Activities of Extraterritorial O	0	0	0	1	0	0	0
26	Pueyo	1	1	0	0	J: Information and Communicat	0	0	0	0	0	0	1
27	Puglia, Ficarola, A. Leoni, L	0	0	0	1	J: Information and Communicat	0	1	1	0	0	0	1
28	Pyakurel	1	0	0	0	NA	1	0	0	0	1	0	1
29	Raghavan, Parman	0	1	0	0	J: Information and Communicat	0	0	0	0	0	0	1
30	Rasillo	1	0	0	1	NA	1	1	1	0	0	0	1
31	Rossi	0	0	0	1	J: Information and Communicat	0	0	0	0	1	1	1
32	Samerski	1	0	0	0	NA	1	0	0	0	0	0	1
33	Lange, Pohl, Santarius	1	1	0	0	J: Information and Communicat	0	0	0	0	1	0	1
35	Temmerman, van den Broe	0	0	0	1	J: Information and Communicat	0	1	0	0	1	0	1
36	Vitari	0	0	0	1	K: Financial and Insurance Acti	0	0	0	0	1	0	1
37	Westermayer	1	1	0	1	J: Information and Communicat	0	0	0	0	1	1	1
38	Widdicks, Ringenson, Parg	1	1	0	0	J: Information and Communicat	0	0	0	0	0	1	0
39	Zoellick, Bisht	1	1	1	1	NA	1	0	0	0	1	0	1
*	Chen	1	0	0	0	J: Information and Communicat	0	0	0	0	1	0	1
		14	16	8	15	0	11	12	4	5	18	11	27

		Argumentation			Takeaway			Testing	Imaginaries	Research Method				
Identifier	Authors	Narrative	Models	Theory	Method	Tool	Best practices	Validation		Survey	Interviews	Focus group	Design analysis	Literature analysis
1	Abbing	1	0	0	1	0	1	0	1	0	0	0	1	0
3	Bonauiti	1	0	1	0	0	0	1	0	0	0	0	0	1
5	de Valk	1	0	0	0	0	1	0	0	1	0	0	0	1
7	Edwards & Espelt	1	0	0	0	0	0	1	0	1	1	0	0	0
9	Garcia, Jeronimo, & Carva	1	0	0	1	0	0	0	1	0	0	0	0	1
10	Haucke	1	0	0	0	0	0	0	0	1	0	0	0	0
11	Heikkurinen	1	0	0	1	0	0	0	1	0	0	0	0	1
12	Howson	1	0	0	0	0	1	0	0	0	0	0	0	1
13	Ibrahim & Sarkis	1	0	0	0	0	1	0	1	0	0	0	0	1
14	Kallis et al. (303-306)	1	0	0	0	0	0	0	1	0	0	0	0	1
15	Kerschner et al.	1	0	0	0	0	0	0	1	0	0	0	0	1
17	Kostakis, Latoufis, Liarokap	1	0	0	1	0	1	0	1	0	0	0	0	0
19	Likavčan, Scholz-Wäckerle	1	0	0	1	0	1	0	1	0	0	0	0	1
20	Macgilchrist	1	0	0	0	0	0	0	1	0	0	0	0	0
21	March	1	0	0	0	0	1	0	1	0	0	0	0	1
23	Pansera, Ehrichs, Kerschn	0	0	0	0	0	0	0	1	0	0	0	0	0
24	Pérez-Garcia	1	0	0	0	0	0	0	1	0	0	0	0	1
25	Pollex, Lenschow	1	0	0	0	0	0	0	0	0	0	0	0	1
26	Pueyo	1	0	0	0	0	0	0	1	0	0	0	0	1
27	Puglia, Ficarola, A. Leoni, L	1	1	0	1	1	1	0	1	0	0	0	0	0
28	Pyakurel	1	1	1	1	1	0	0	1	0	0	0	0	1
29	Raghavan, Parman	1	0	0	1	0	1	0	1	0	0	0	0	1
30	Rasillo	1	0	0	0	0	1	1	1	0	1	0	0	0
31	Rossi	1	0	0	1	0	1	0	1	0	0	0	0	1
32	Samerski	1	0	0	0	0	1	0	1	0	0	0	0	1
33	Lange, Pohl, Santarius	1	1	1	1	0	0	0	0	0	0	0	0	1
35	Temmerman, van den Broe	1	0	0	0	0	1	0	1	0	0	0	0	1
36	Vitari	1	0	0	0	0	0	0	0	0	0	0	0	1
37	Westermayer	1	0	0	0	0	1	0	1	0	0	0	0	1
38	Widdicks, Ringenson, Parg	1	0	0	0	0	1	1	1	0	0	0	0	0
39	Zoellick, Bisht	1	1	0	1	0	0	0	1	0	0	0	0	1
*	Chen	1	0	0	0	0	1	0	1	0	0	0	0	1
		30	4	3	11	2	15	4	23	3	2	0	1	22

Identifier	Authors	Thought experiment	Case study	Dialogue	Technical Report	Observation	Data analysis	Experiment
1	Abbing	0	0	0	0	0	0	0
3	Bonauiti	0	0	0	0	0	0	0
5	de Valk	0	0	0	0	0	0	0
7	Edwards & Espelt	0	0	0	0	1	0	0
9	Garcia, Jeronimo, & Carval	0	0	0	0	0	0	0
10	Haucke	0	1	0	0	0	0	0
11	Heikkurinen	0	0	0	0	0	0	0
12	Howson	0	0	0	0	0	0	0
13	Ibrahim & Sarkis	0	1	0	0	0	0	0
14	Kallis et al. (303-306)	0	0	0	0	0	0	0
15	Kerschner et al.	0	1	0	0	0	0	0
17	Kostakis, Latoufis, Liarokap	0	1	0	0	0	0	0
19	Likavčan, Scholz-Wäckerle	0	0	0	0	0	0	0
20	Macgilchrist	0	0	0	0	0	0	0
21	March	0	0	0	0	0	0	0
23	Pansera, Ehrichs, Kerschn	0	0	1	0	0	0	0
24	Pérez-Garcia	0	1	0	0	0	0	0
25	Pollex, Lenschow	0	0	0	0	0	0	0
26	Pueyo	1	0	0	0	0	0	0
27	Puglia, Ficarola, A. Leoni, L	0	0	0	1	0	0	0
28	Pyakurel	0	0	0	0	0	0	0
29	Raghavan, Parman	0	0	0	0	0	0	0
30	Rasillo	0	0	0	0	1	0	0
31	Rossi	0	1	0	0	0	0	0
32	Samerski	0	0	0	0	0	0	0
33	Lange, Pohl, Santarius	0	0	0	0	0	1	0
35	Temmerman, van den Broe	0	0	0	0	0	0	0
36	Vitari	0	0	0	0	0	0	0
37	Westermayer	0	0	0	0	0	0	0
38	Widdicks, Ringenson, Parg	0	0	0	0	0	0	1
39	Zoellick, Bisht	0		0	0	0	0	0
*	Chen	0	0	0	0	0	0	0
		1	6	1	1	2	1	1

H Mapping study results, graphs per focus

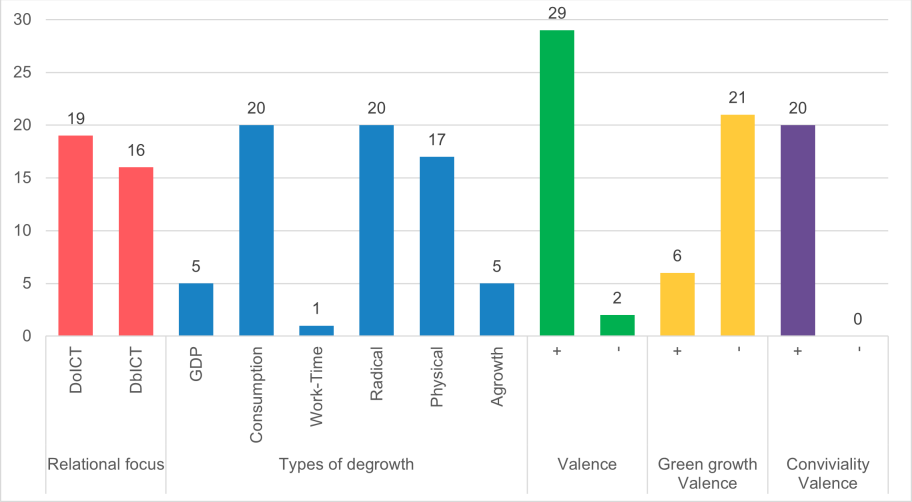

Figure 23: Graph of mapping study results for the degrowth focus.

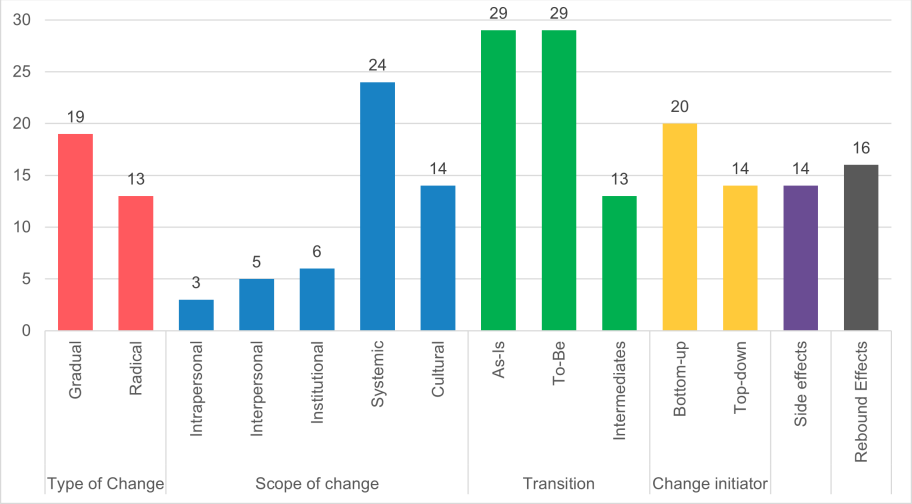

Figure 24: Graph of mapping study results for the change focus.

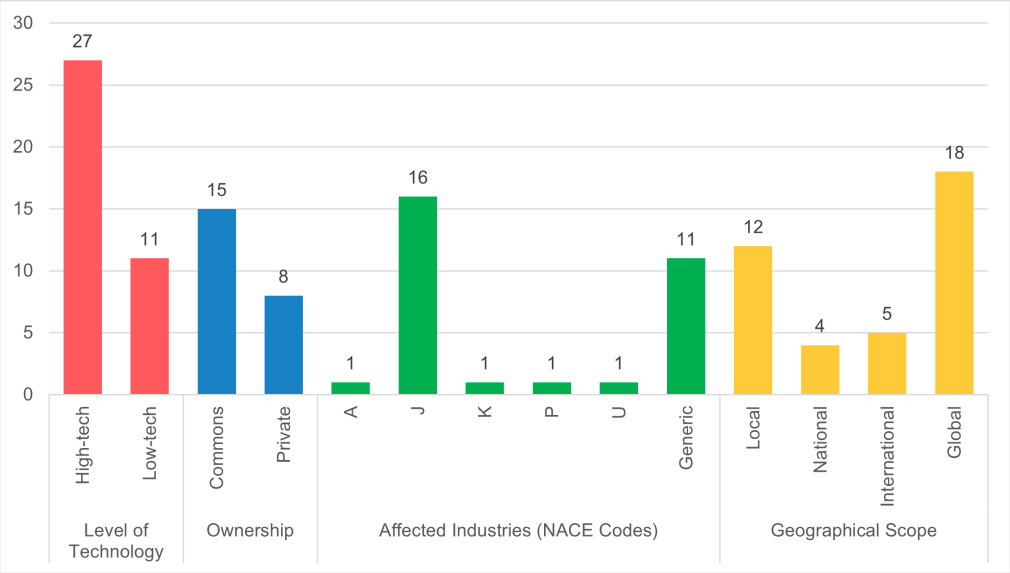

Figure 25: Graph of mapping study results for the technology focus.

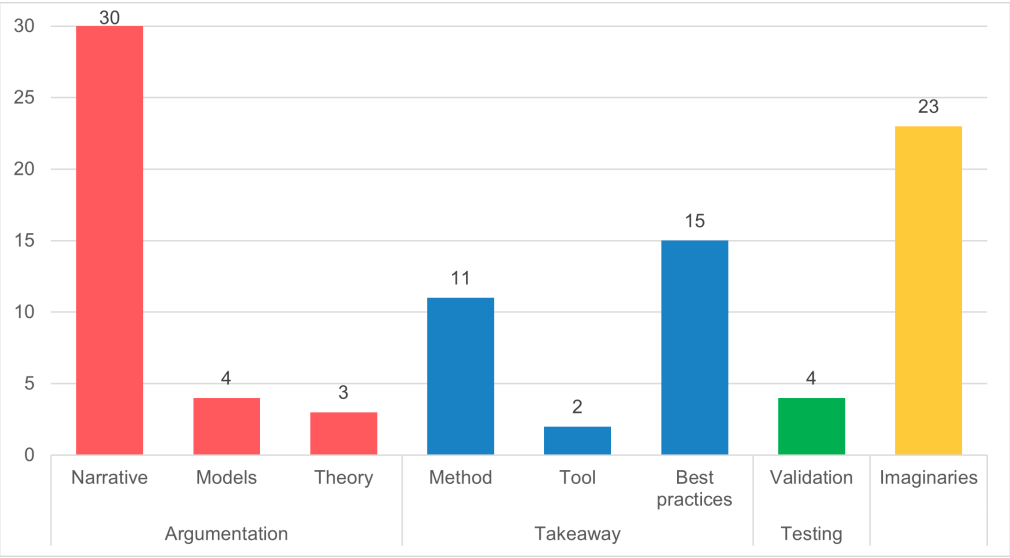

Figure 26: Graph of mapping study results for the contribution focus.

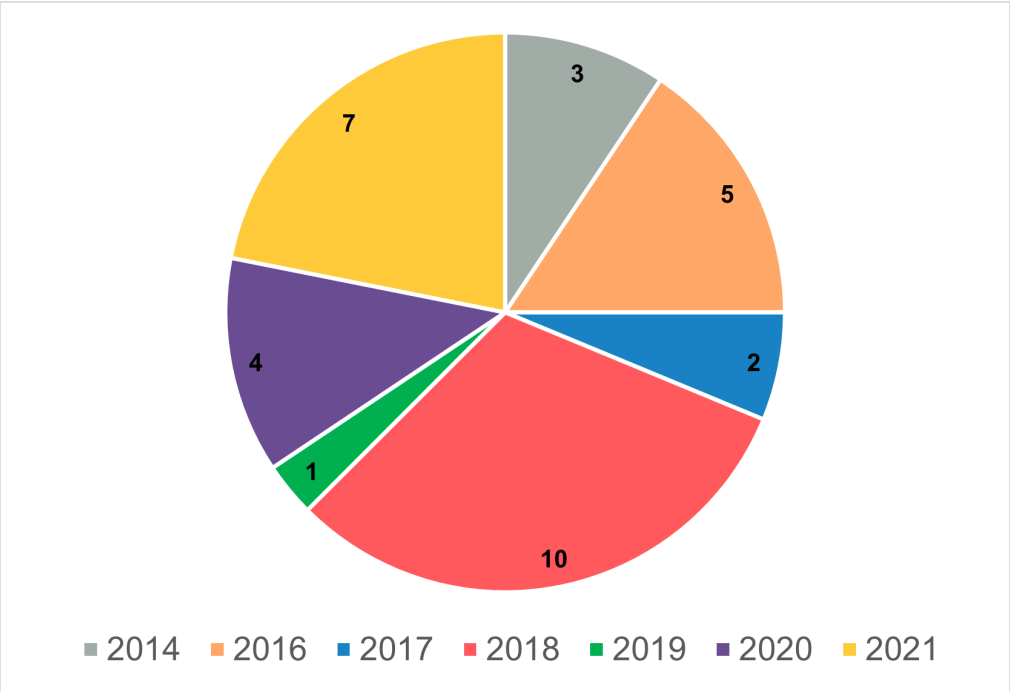

Figure 27: Graph of mapping study results for the year of publication dimension.

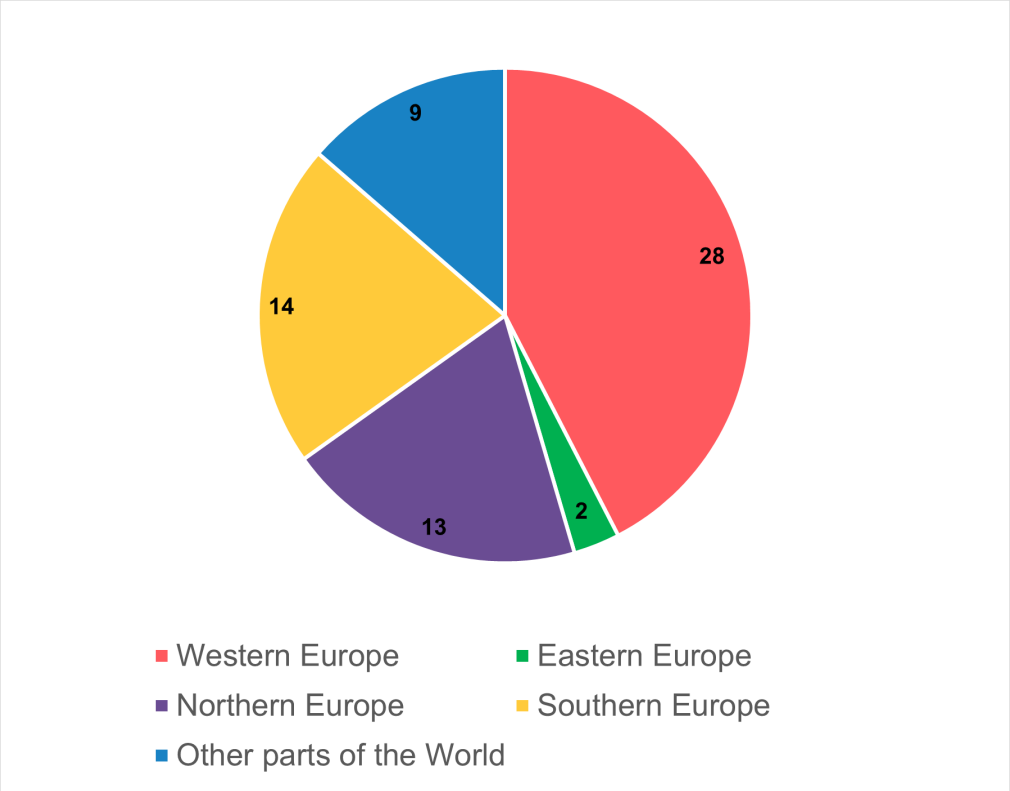

Figure 28: Graph of mapping study results for the countries of affiliation dimension.