MultiFutures
SUSTAINABLE, RESILIENT AND FAIR EUROPE

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Mapping and analysis of alternative growth paradigms

Towards a taxonomy and storylines of alternative growth paradigms for use in the MultiFutures project

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Draft Report

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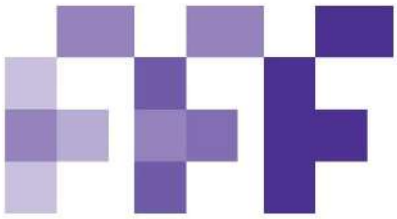

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2 Executive Summary

This report presents an analysis of the alternative growth debate taking place in the scientific, public and policy realm. Aim is to provide a taxonomy of paradigms and to develop, based on this taxonomy, different storylines of alternative societal futures that can be used as inputs for modelling in subsequent Work Packages of the MultiFutures project.

The research was conducted in four consecutive steps: search, selection, analysis and synthesis. In the Search phase, different paradigms were explored, starting with a set of 7 paradigms from previous research. This set was expanded to 41 paradigms based on survey inputs within the MultiFutures team and an AI search. In the Selection phase, criteria were set on which to select the paradigms. These resulted in a set of 12 paradigms for further analysis. Based on this selection, the policy, academic and public debate on alternative growth were mapped, showing a sharp rise of publications over the years 2012-2023 in particular for Green Growth and Degrowth as well as a global spread of the debate with a focus in Europe and the United States. In the Analysis phase, an systemic AI based comparison of the 12 paradigms was conducted, by extracting and synthesizing key features from leading academic and policy publications. In this analysis, 15 main features of each paradigm were retrieved and compared.

From this research, a taxonomy of paradigms emerged from which 4 main storylines were derived, each with a profoundly different normative vision on the meaning of ‘societal welfare’ in the future and a different preferred route to achieve the desired outcomes: Mission Economy, Post Growth, Green Growth and Great Mindshift. Further research in the MultiFutures project will turn these qualitative storylines into quantitative policy scenarios to be used as inputs for modelling to reveal potential impacts of the different societal futures envisaged in the storylines.

3 Introduction

With present and planned international policies, it seems unlikely that global climate and sustainable development goals will be achieved (IPCC, 2022; UN, 2023). In addition, scientists warn that out of a set of nine scientifically recognized planetary boundaries six are already surpassed (Richardson et al., 2023). Unconventional societal and policy pathways might therefore be necessary to meet the environmental and social needs of the future.

3.1 The MultiFutures Project

The MultiFutures project aims to provide such pathways by building on alternative growth paradigms that are currently discussed in the scientific, public and policy debate taking place under the heading of 'Beyond Growth'. A selection of the main paradigms will be converted into distinct 'Beyond Growth' storylines[1]. The storylines will be complemented with concrete quantitative policies to form scenarios that correspond to the respective 'Beyond Growth' storyline. In this way, a set of 'Beyond Growth' scenarios is formed for which the potential impacts on society will be modelled with the modelling tools available in the MultiFutures project. For the quantitative and qualitative assessment, a broad set of wellbeing indicators will be used in order to assess wider impacts on society.

The MultiFutures project as a whole consists of seven main work packages, which are outlined in Table 1.

WP NR	WORK PACKAGE DESCRIPTION
1	Exploring the Landscape of Alternative Growth Paradigms
2	Creating Common Ground for Sustainable and Equitable Futures: A Stakeholder-Driven MultiFutures Initiative
3	Novel Policy Options for Alternative Futures
4	Exploring and Simulating Alternative Transition Scenarios
5	Impact and Pathways towards Alternative Futures
6	MultiFutures Outreach strategy: Dissemination, Exploitation and Communication
7	Project Management

Table 1: MultiFutures work packages

[1] For a definition of the terms 'paradigm', 'storyline' and 'scenario' see section 2.1

3.2 Exploring the landscape of alternative growth paradigms

Work Package 1 of the MultiFutures project consists of three tasks. In task 1 (T1.1), the international debate on alternative growth paradigms is mapped as a basis for developing alternative scenarios in MultiFutures. A limited number of paradigms is selected for development of storylines that will be further developed into scenarios and explored in the subsequent work packages of MultiFutures. Task 2 (T1.2) compares the storylines developed in T1.1 with existing EU policies and policy principles. In this task, a set of six selected EU and non-EU countries serves as a basis for the analysis, together with overall EU policies. Task 3 (T1.3) finally examines existing, mainstream scenarios from various organisations (e.g. IPCC, EU, OECD) in order to provide feasible baseline indicators for developing the alternative growth storylines of T1.1 into quantitative scenarios.

Deliverables of WP1 are outlined in Table 2.

DELIVERABLE NR	TITLE	DESCRIPTION	DUE DATE (PROJECT MONTH)
D1.1	Paradigm taxonomy	Figure; Public Report	9
D1.2	Aligning Alternative Growth Paradigms with EU principles	Green paper; Public Report	12
D1.3	Final Climate Transition Scenarios Based on Alternative Paradigms	Public Report	21
D1.4	Navigating New Societal Futures; Promises and Pitfalls	Scientific article; Public Report	24
D1.5	Preliminary list of candidate transition scenarios	Public Report	15

Table 2: Deliverables of Work Package 2

3.3 This report

This report reflects the analysis, results and conclusions done so far in the MultiFutures project, which led to a paradigm taxonomy and a selection process of storylines for further analysis in MultiFutures. In this report, the selection process of alternative growth paradigms will be outlined that leads to several qualitative storylines. In further work in the project, these storylines will be enriched with detailed data and policies in order to provide quantitative scenarios that can be

used as inputs for modelling. The taxonomy figure in this report will also be made available on the MultiFutures Knowledge Platform (forthcoming on multifutures.eu).

Table 3 outlines how T1.1 goals are translated into the research approach as reflected in this report.

GRANT AGREEMENT (GA) TEXT T1.1	WAY THE GA TEXT IS ADDRESSED
This task conducts a comprehensive and qualitative mapping of the state of the art of alternative growth paradigms, both globally and within the EU, as they appear in the academic literature and public discourse. To achieve this paradigm taxonomy (KR#1), the analysis will outline the 1) proposed goals, 2) proposed policy instruments, 3) recommended indicators, 4) inferred (qualitative) impacts on planetary boundaries, and 5) inferred impacts on societies of the identified paradigms. AI tools (see P#III) are used to efficiently and accurately identify and cluster relevant content.	See step 6 of the research approach for a mapping of the scientific, policy and public debate. See step 7 for the analysis of the paradigm features and step 9 for the final taxonomy proposed.
The task will deepen the theories of change associated with the identified paradigms by examining four key characteristics: underlying assumptions, limitations, strengths and weaknesses and implications (incl. for vulnerable groups). Based on any gaps identified within these theories, opportunities & bottlenecks to implementing alternative growth paradigms will be outlined.	See chapter 7 for a discussion of opportunities and bottlenecks to implementing alternative growth paradigms in practice.
In addition, stakeholders will be involved in the process (see T2.1-2.4). They will be presented with the preliminary matrix of the comparative analysis and asked to provide their opinions, insights, and suggestions (T2.2, 2.4), while the large-scale survey will provide a deeper understanding of citizens' perception of alternative growth paradigms. This engagement will ensure a more robust and comprehensive understanding of alternative growth paradigms and their potential impacts.	Due to the partly conflicting timelines of WP1 and 2, the final outputs of WP2 cannot be used to reflect on WP1. Rather, the outputs of the stakeholder process in WP2 will feed into the final scenario design in WP3.
The output of T1.1 will be a consolidated overview of the state of research and public discussion on alternative growth paradigms, as well as a visual taxonomy of these paradigms, providing a clear and accessible representation of the field.	See this report as a whole.
The matrix will be made available on the Knowledge Platform (KR#7).	See the MultiFutures website. MultiFutures

Table 3: Grant Agreement text 1.1 in relation to research approach

4 Research Approach

To map the alternative paradigm discourse and develop transition storylines, we employ a stepwise process. In the following chapter this overall research approach is outlined.

4.1 Definitions

For the purposes of this report, a **'paradigm'** is considered to be a distinct set of concepts or thought patterns, including theories, research methods, postulates, and standards, that serves as a framework within which theories are formulated, experiments are conducted, and data is interpreted. These concepts and thought patterns together are referred to in this report as **'paradigm features'.** Hence, a paradigm can be distinguished from other paradigms by its different positions towards a characteristic set of paradigm features.

'Alternative growth paradigms' are identified based on an analysis of the international scientific and public 'Beyond Growth' debate. 'Beyond Growth' is seen as the umbrella term for the whole debate about alternative growth paradigms, hence comprising all paradigms in discussion - without by itself implying a choice whether or not 'economic growth' should be pursued. 'Alternative growth paradigms' and **'Beyond Growth paradigms'** are therefore regarded as equivalents in this deliverable.

A **'storyline'** is defined as a qualitative and coherent description of paradigm features that together describe the outline of a potential societal future and the route towards such a future. Based on the clustering and taxonomy of paradigms developed in this report, four concrete storylines are presented that each comprise different positions with regard to the main distinctive paradigm features found in the research process.

A **'scenario'** is regarded as an expanded and quantified storyline that also contains more detailed sectoral policies and a set of baseline variables that are the same for each storyline. After the storylines have been developed (see below), further work in the MultiFutures project will work out to quantify the qualitative storylines by defining a set of "general" exogenous inputs, which will be used by all the models included in the MultiFutures modelling framework.

4.2 Overview of the applied research methods

We used a 10 step methodology in order to, first, identify relevant Beyond Growth paradigms and, then, develop a categorization of paradigms leading to a taxonomy of paradigms and storylines for further use in MultiFutures (see Figure 1 below).

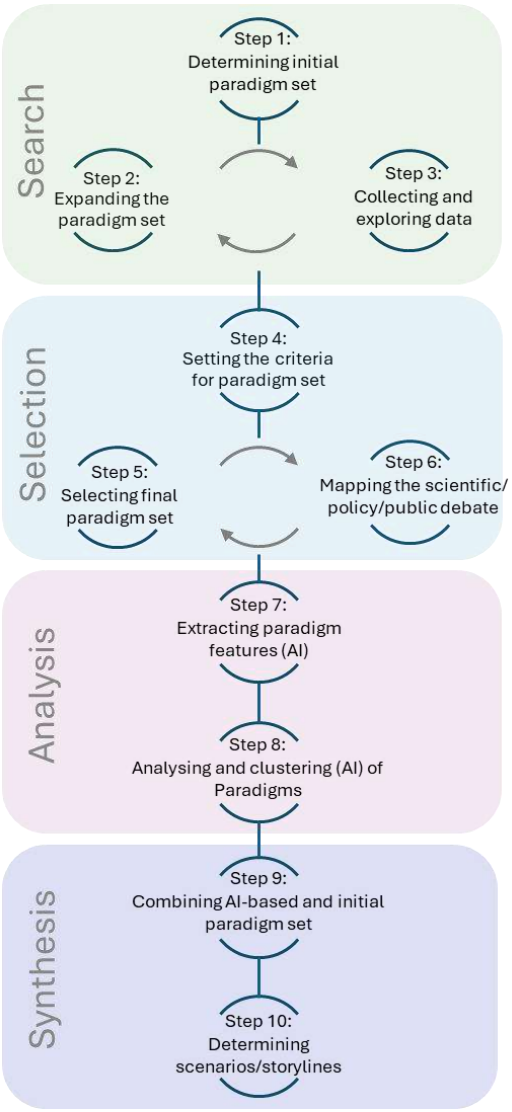


Figure 1: Main steps in the research methodology

To map the Beyond Growth debate and develop storylines, we combined qualitative and quantitative methods. We started from a previous qualitative assessment of Beyond Growth paradigms (i.e. Slingerland et al., 2024). In this report, an explorative assessment was made of the Beyond Growth debate in which seven international and four Dutch Beyond Growth paradigms were analysed (see for more information on this step 1 of the research approach). After that, we expanded the paradigm set and performed a quantitative mapping of the paradigm data with the aim to select promising paradigms from the expanded data set and to map the alternative growth debate. An analysis using artificial intelligence (AI) was then conducted to determine detailed features of the paradigms. Finally, by combining the results of the qualitative and AI analyses, four different Beyond Growth storylines were developed and proposed to use for further work in MultiFutures towards quantitative scenario development.

4.3 Research steps in detail

The research steps are grouped into four main stages: search, selection, analysis and synthesis. Each of these phases consists of several steps, as outlined in Figure 1.

The **search stage** consists of three main steps. In step 1, a paradigm set from a previous qualitative alternative growth paradigm mapping project is outlined as an input to this project (Slingerland et al., 2024). In step 2, the paradigm set is expanded with the outcomes of a survey circulated among the MultiFutures consortium members. In the survey, the consortium members also validated a working definition of the concept “paradigm” (see above)... To subsequently expand the paradigm set, we iteratively employ data collection research and exploratory analysis in step 3.

The paradigm **selection stage** also consists of three consecutive steps. In step 4, based on the working definition of a paradigm that was developed, we define more detailed criteria for selecting paradigms for further analysis. In step 5, a final paradigm set is selected with assistance from an AI-based criteria framework application. Quantitative mapping of the scientific and political discourse around the selected paradigms is performed in step 6.

The **analysis stage** of the research approach consists of two steps: step 7 involves an AI extraction of key features of the selected paradigms, such as their views towards GDP, norms and values change, and the suggested policies to arrive there. This step provides a basis for the clustering of the paradigms using AI methodology and qualitative analysis in step 8.

The **synthesis stage** of the research approach comprises two final steps: in step 9, the analyses of step 7 and 8 are integrated with the outcome of the more qualitative clustering of the paradigms that was used as the starting point of the research (step 1). After that, in step 10 a final decision is taken on storylines for further use in MultiFutures based on the selected key features for each scenario.

4.4 Reading guide

Table 4 provides the overall reading guide of this report. After the introduction and overview of the research method in chapters 1 and 2, the search, selection, analysis and synthesis phases of the research are outlined in chapters 3 to 6 respectively. Chapter 7 discusses the research method and results obtained. Finally, chapter 8 provides the main conclusions and links to the further subsequent work in the MultiFutures project.

CHAPTER	CONTENTS
1	Introduction
2	Research Approach
3	Search: Research steps 1, 2, 3
4	Selection: Research steps 4, 5, 6
5	Analysis: Research steps 7, 8
6	Synthesis: Research steps 9, 10
7	Discussion
8	Conclusions and linkages with other WPs in MultiFutures

Table 4: Outline of the chapters of the report

5 Exploring alternative growth paradigms

The first three steps of our research aim to expand the set of potential Beyond Growth paradigms that serve as an input for our further analysis. The logic behind this process is to start our analysis with the broadest possible set of potential Beyond Growth paradigms, in order to make sure that we do not miss any relevant paradigms.

5.1 Step 1 - Determining initial paradigm set

Initial paradigm set

Our starting point for the analysis is a list of 11 paradigms included in 'Analysing the Beyond Growth Debate' (Slingerland et al., 2024), see Source: Slingerland et al., 2024

Figure 2. The set consists of seven paradigms related to international society and four Dutch national paradigms. The Dutch paradigms were removed from the initial set as they were partly overlapping with the international concepts and partly referring specifically to the Dutch societal context. Therefore our initial paradigm set included the following seven international Beyond Growth paradigms:

1. Green Growth
2. Mission Economy
3. Degrowth
4. Doughnut Economy
5. Broad Welfare
6. Great Mindshift
7. Buen Vivir

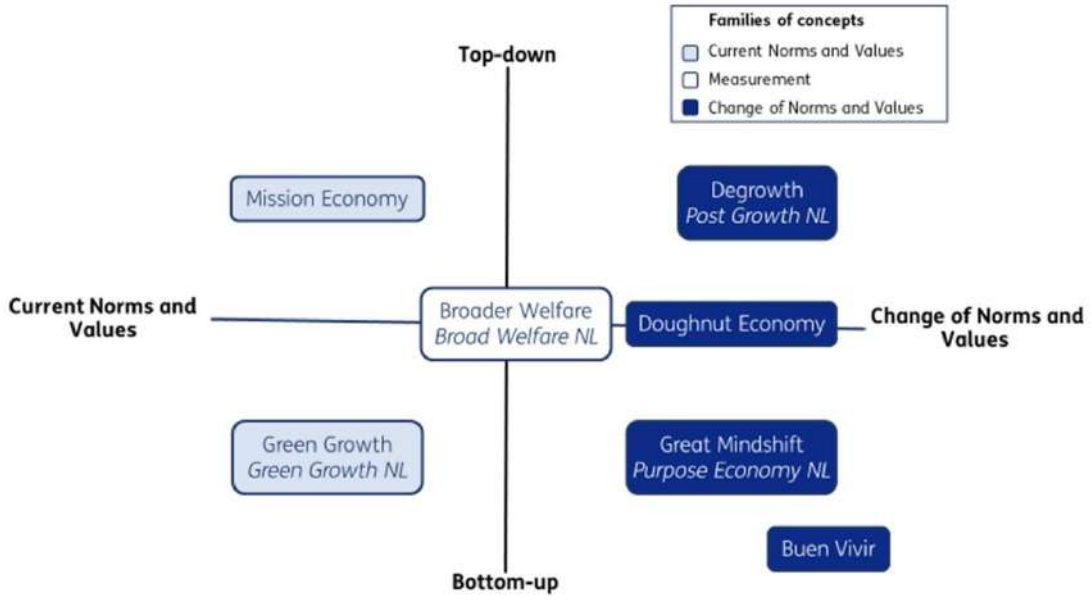
In Source: Slingerland et al., 2024

Figure 2, the paradigms are shown as grouped into a taxonomy based on the previous qualitative analysis performed in Slingerland et al. (2024). Key distinctive features that were examined in this previous analysis were visions/positions of the paradigms towards:

- GDP / economic growth
- Norms / values change
- Redistribution
- Technological innovation
- Scaling mechanism / main actor

The seven paradigms were found to be different regarding their views on norms and values change (e.g., norms and values with regard to the importance of personal property vs. sharing of assets and energy, as well as regarding the importance of growth) and regarding their direct or indirect role of the government in the transition towards a more sustainable society. Therefore, these two features were used as the key distinguishing dimensions between the paradigms (see Source: Slingerland et al., 2024

Figure 2). ‘Top-down’ was considered to stand for a strong and direct governmental role, ‘bottom-up’ for another group of stakeholders as main drivers for change. Governmental influence is not excluded in the ‘bottom-up’ view. For example, in Green Growth the government may set the playing field of the market by implementing an emissions trading system, but market actors are the main drivers for change. Alternatively, in Mission Economy, the government might to make direct technological innovation choices and to enforce these with direct implementation measures.



Source: Slingerland et al., 2024

Figure 2: Initial paradigm set and taxonomy

5.2 Step 2 - Expanding the initial paradigm set

Expansion of the paradigm set was pursued by designing an internal survey to all members of the MultiFutures consortium. The survey also explored the consortium's views on a draft definition of what should be considered a “Beyond Growth paradigm”. In the survey, we asked the consortium members three questions:

- First, for their thoughts and input on our proposed working definition of the concept “Beyond Growth paradigm” (these responses are analysed below);
- Second, to provide names of additional paradigms that they consider interesting for us to consider;
- And third, about additional search terms / keywords related to the paradigms they proposed to include.

Based on answers to the survey, a working definition was presented to the whole MultiFutures team in May 2023. In this session, the definition was discussed in detail by the project members present. To ensure inclusivity, as not all members could attend the meeting, the working definition was also shared in a follow-up survey. Consortium members were invited to provide their feedback and suggestions. With these contributions, a final version of the definition was developed and formally adopted by the MultiFutures consortium:

*An **‘alternative growth / Beyond Growth paradigm’** is considered in this work package as a proposal for systemic and societal change that*

1. *Plays a role in the public and academic ‘Beyond Growth’ debate;*
2. *Aims to contribute to providing solutions for current sustainability crises challenges;*
3. *Is comprehensive/ holistic over the whole economy;*
4. *Aims to be geographically diverse; and*

5. *Aims to lead to increased societal welfare and individual wellbeing by suggesting policies to adapt or change existing economic, social and/or institutional structures in our society.*

Grouping of paradigms

The survey responses resulted in 34 new key words as potential paradigms, in addition to the original seven paradigms, leading to 41 paradigms in total (see Table 5). Based on initial apparent similarities of the potential paradigms, we clustered them into 16 groups. Similarities used for the initial grouping comprised:

- Similar names - e.g. 'Beyond Growth' and 'Beyond GDP' (group 1);
- Conceptual similarities based on the previous project (Slingerland et al., 2024) - 'Great Mindshift' and 'Transition Theory' (group 7);
- Apparent and possible conceptual similarities based on first screening -
  - *Economic growth related:* 'Green Growth', 'Clean Growth', 'Eco-growth', '(Inclusive) Green Economy', 'Sustainable Growth' and 'Sustainable Economy' (group 2);
  - *Double environmental and social borders related:* 'Doughnut/Donut Economy' and 'Consumption Corridors (group 6);
  - *Community and individual wellbeing related, Southern concepts:* 'Buen Vivir', 'Sumak kawsay', 'Good life economy', 'Happiness economy, 'Ubuntu economy' (group 9);
  - *Indicator-dashboard related*: 'wellbeing economy' and 'broad welfare' (group 10);
  - *Zero economic growth related:* 'Steady state economy', 'Zero growth economy' and 'Sufficiency economy' (group 11);
  - *Resources related:* 'Circular Economy' and 'Regenerative Economy' (group 13);
  - *Primarily business related:* 'economy of the common good' and 'Purpose Economy' (group 14);
  - *Individual stakeholder or sector related:* 'Digital economy', 'Bioeconomy', 'Ecofeminism', 'femini* economy', 'femini* political economy' and 'Care economy' (group 15);
  - *Individual key words, not directly related to others in first screening:* 'Mission economy', 'Post growth', 'A-growth', 'Solidarity economy', 'Degrowth' and 'Populist right economies' (groups 3, 4, 5, 8, 12, 16)

	REASONS FOR GROUPING	PARADIGM KEY WORDS
1	Beyond Growth related (overarching)	Beyond Growth (and economy); Beyond GDP (and economy)
2	Green Growth related (economic growth and environmental policies)	Green Growth; Green economy; Clean growth (and economy); Eco-growth; Eco modernism; Inclusive Green Economy; Sustainable growth (and economy); Sustainable economy (and growth)

	REASONS FOR GROUPING	PARADIGM KEY WORDS
3	Mission economy related (governmental missions)	Mission economy
4	Post growth related (containing term Post growth)	Post growth
5	A-growth related (containing term A-growth)	A-growth (and economy)
6	Doughnut related (double social and environmental borders) economics	Doughnut economy; Donut economy; Consumption corridors
7	Great Mindshift related (containing term Great Mindshift or Transition*)	Great mindshift; Transition theory (economy)
8	Solidarity economy related	Solidarity economy
9	Buen Vivir related (Southern initiated paradigms)	Buen Vivir; Sumak kawsay; Ubuntu economics; Good life econom; Happiness economy
10	Indicator dashboard related	Wellbeing economy; Broad Welfare
11	Steady state economy related	Steady state economy; zero growth economy; sufficiency economy
12	Degrowth related	Degrowth
13	Circular economy related (resource focus)	Circular economy; regenerative economy
14	Primarily business focus	Economy of the common good; Purpose economy
15	Sectoral and specific target group focus	Digital economy; Bioeconomy; Ecofeminism; femini* economy; femini* political economy; Care economy
16	Non-environmental focus	Populist right economy

Table 5: Initial grouping of paradigm key words

5.3 Step 3 - Exploring the expanded paradigm set

Step 3 comprised the search and collection of data from academic literature, policy documents, and public discussions to support the expansion and grouping of the paradigm keyword set in Step 2. In this step, we used the set of paradigm grouped keywords defined to conduct a comprehensive search in selected data sources.

Selection of data sources

Academic literature, policy documents and public discussions were used for searching content relating to alternative economic paradigms. Data sources used for the quantitative mapping and the AI analysis were:

- Academic literature:
  - Elsevier Scopus (https://www.scopus.com/)
- Policy documents:
  - Elsevier SciVal (Scopus) (https://www.elsevier.com/products/scival)
  - EC OECD STIP Compass (https://stip.oecd.org/stip/)
- Public discussions:
  - GDELT (https://www.gdeltproject.org/data.html)

Elsevier Scopus is a comprehensive, multidisciplinary abstract and citation database offering a wide coverage of scientific journals, conference proceedings, and books.

Elsevier SciVal leverages publications data from Scopus providing analyses of scholarly output such as summary metrics, publications grouping by subject area, keyword phrase analysis, and countries and regions analysis. It also identifies policy mentions, publications cited by policy and policies, and gives geographic spread of these policies. SciVal gets its policy data from **Overton.io,** which is a comprehensive database including policy documents, guidelines, think tank publications and working papers. This feature was used to collect information about policy documents relating to publications of alternative growth paradigms. SciVal analyses were made for different alternative growth paradigms, and keyword phrase analysis was explored to identify additional keywords for the paradigm expansion.

EC OECD STIP Compass is a joint initiative of the European Commission (EC) and the OECD collecting science, technology and innovation (STI) policy data. This is another source used for searching policy literature and reviewing volume of policy documents based on keywords.

GDELT is a real-time, open-source index of global news media. It captures and analyses news articles and online sources, providing insights into events, topics and trends worldwide. GDELT was used to analyse the volume and geographical distribution of content related to public discussions on alternative economic paradigms.

Results of exploratory data analysis

Searching and defining keywords for alternative paradigms was an iterative process. It was found that some keywords were too specific, not showing any or nearly any results at all. Others were found to be too general, with too many non relevant results. As a result, the following keywords were excluded:

- **Great Mindshift:** the exploratory search did not result in a sufficient number of sources to perform a meaningful separate data analysis.
- **Good-Life Economy:** the exploratory search did not result in a sufficient number of sources to perform a meaningful separate data analysis.

- **Sustainable growth** and **sustainable economy**: the exploratory search showed these search terms as too general terms, with too many non-relevant results.

In this way, in total 37 out of the set of 41 keywords from the expanded set of keywords were transferred to step 4 in the analysis.

6 Selection: selecting alternative growth paradigms

In this chapter we will discuss research steps 4, 5 and 6. The chapter will mainly focus on the selection of the alternative growth paradigms to be used for the formulation of the four storylines in step 10.

6.1 Step 4 - Setting the criteria for paradigm set selection

For selecting the final set of paradigms to be used for AI feature extraction, we applied the five criteria of the definition of a 'Beyond Growth paradigm' that was developed in step 2 of the analysis to the set of 37 remaining keywords. To do so, indicators were developed for each aspect of the definition (see Table 6).

PARADIGM DEFINITION ASPECTS	PARADIGM SELECTION CRITERIA
Plays a role in the 'Beyond Growth' debate	1) Includes a view on GDP growth / degrowth / zero growth; 2) Mentions other paradigm search terms, in particular 'Beyond Growth'
Focus on sustainability	3) Mentions to provide solutions to sustainability challenges (e.g. climate change, SDGs)
Comprehensive / holistic	4) Paradigm covers economy as a whole (i.e., multiple economic aspects), not specific sectors
Geographical spread	6) Paradigm to be discussed in multiple countries 7) Northern and Southern paradigms to be included
Suggests policies to adapt or change existing economic, social and/or institutional structures in our society.	8) Concrete policies to be found in the features extraction in step 7

Table 6: Translation of the paradigm selection criteria into criteria for the AI search

To support the qualitative selection of paradigms against the selection criteria formulated, a NLP (Natural Language Processing) analysis with Large Language Model (LLM) integration was conducted. The input for this analysis were abstracts collected from the top-50 cited publications between 2015 and 2023 for each paradigm group, sourced from the Scopus academic literature source described in the previous data collection step.

Figure 3 shows a process chart detailing the steps of the analysis. A retrieval-augmented generation (RAG) pipeline was built to carry out the analysis. RAG is a commonly employed technique that has been demonstrated to improve the deployment of LLMs for knowledge-intensive tasks by combining external data with the LLM's inherent capabilities (Gao et al., 2023; Lewis et al., 2020). User prompts are converted into semantic data to retrieve information from an indexed external database. The retrieved data is then integrated with the LLM's training based knowledge, resulting in more accurate and reliable responses.

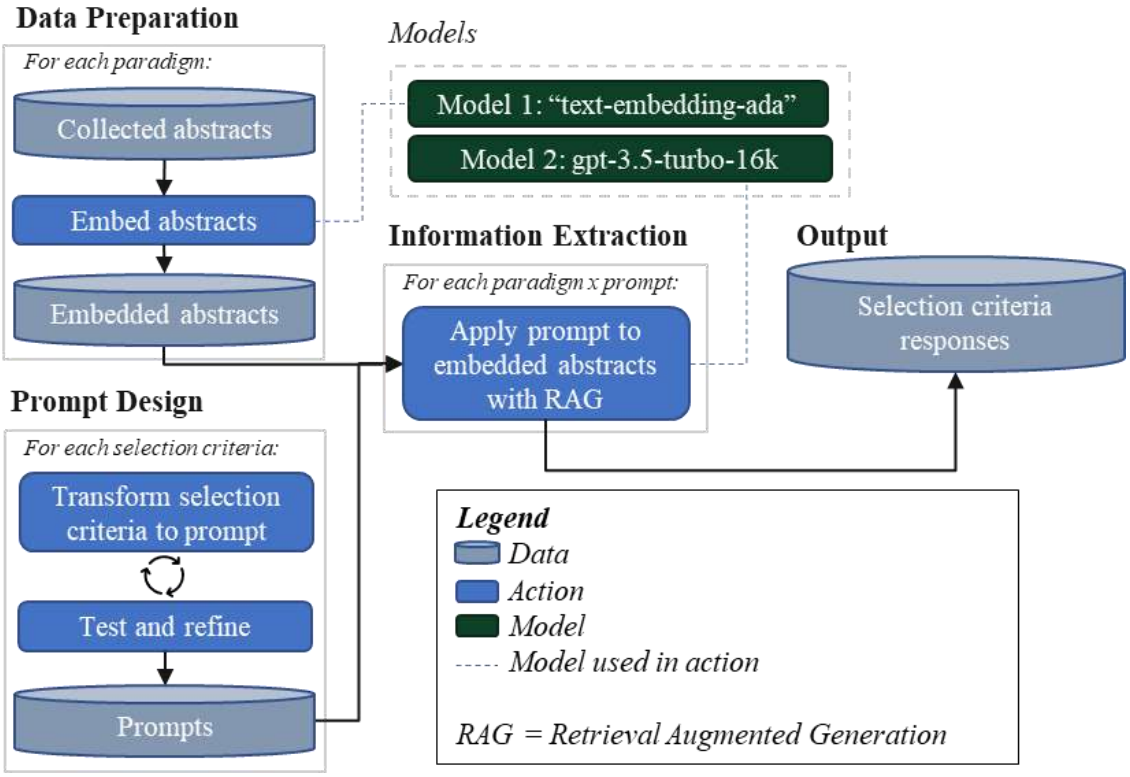


Figure 3: Method for AI selection of paradigms based on the criteria set

For each paradigm group, the selected 50 abstracts were first collected and encoded to numerical representation (a process known as embedding) for further processing using OpenAI's 'text-embedding-ada' model. At the same time, each selection criteria from Table 6 was formatted to be implemented as an LLM prompt. For the purposes of this analysis, the abstracts were consolidated into one index, with each abstract represented as a retrievable chunk of text. The retriever was configured with a top-k of 50, such that for each implementation of the RAG instance, the full set of abstracts would be used, sorted by order of similarity (relevance) to the provided query. For each paradigm group, the RAG pipeline was implemented with each criteria prompt using OpenAI's 'gpt-3.5-turbo-16k' model, resulting in an individual assessment against each criteria dimension.

6.2 Step 5 - Selecting final paradigm set

For selecting the final paradigm set to be used for feature extraction in step 7, we qualitatively reviewed the list of the 37 keywords by applying the selection criteria formulated in step 4:

- 'Solidarity economy' was removed from the set as not directly linked to ecological change;
- 'Populist-right economics' was removed from the search as not being directed at ecological change;
- 'Circular economy' and 'Regenerative economy' were removed from the search as being directed at efficient resource use mainly, without a clear normative direction for societal change as a whole;
- 'Economy of the common good' and 'Purpose Economy' were removed from the search as being primarily directed at internal change of business;

- ‘Digital economy’, ‘Bioeconomy’, ‘Care economy’ were removed from the search as being directed at single sectors only;
- ‘Ecofeminism’, ’Feminist economics’ and ‘Feminist political economy’ were removed from the search as being directed at single stakeholder groups only;
- ‘Beyond Growth’ and ‘Beyond GDP’ were taken as the umbrella terms for the whole discussion and hence excluded as individual paradigms to be assessed;
- ‘Ecomodernism’ and ‘Inclusive green economy’ were seen as sub-terms of ‘Green Growth’ or ‘Green economy’ and hence excluded.

Furthermore, some apparent equivalents were taken together, to be regarded as one paradigm:

- ‘Green Growth’, ‘Clean growth’, ‘Eco-growth’ and ‘Green economy’ were seen as equivalents. Hence merged into one paradigm, under the heading ‘Green Growth’.
- ‘Doughnut economy’, ‘Donut economy’ and ‘Consumption corridors’ were seen as equivalents. Hence merged into one paradigm, under the heading ‘Doughnut economy’.
- ‘Buen Vivir’ and ‘Sumak kawsay’ were seen as equivalents. Hence merged into one paradigm, under the heading ‘Buen Vivir’.
- ‘Steady state economy’ and ‘Zero growth economy’ were seen as equivalents. Hence merged into one paradigm, under the heading ‘Steady state economy’.

The paradigm ‘Great Mindshift’ was excluded in step 3, since it did not show up in the scientific and policy analysis performed there. In fact, the term is only used by one source, a non-academic book publication (Göpel, 2016). However, in the qualitative assessment the book was found to be an eclectic representation of transition theory. Therefore it was decided to merge ‘Great Mindshift’ and ‘Transition Theory’ to one as equivalents - using the term “Great Mindshift” as a name for this merged concept.

The performance of the AI analysis described in step 4

After the qualitative sub-selection, we assessed the paradigms with AI analysis on the formulated criteria. To do so, we used the outcomes of the LLM-based criteria selection assessment in step 4 as a starting point for further selection. This enabled us to compare the outcomes for the different paradigms that were left after the qualitative sub-selection described above, and assess whether the criteria were met. The 14 paradigms considered for appraisal after the qualitative selection were: “Green Growth”, “Mission Economy”, “Post Growth”, “A-Growth”, “Doughnut Economy”, “Transition Theory”, “Buen Vivir and Sumak Kawsay”, “Happiness Economy”, “Ubuntu Economy”, “Wellbeing Economy”, “Broad Welfare”, “Steady State and Zero Growth”, “Sufficiency Economy”, and “Degrowth”.

The quantitative assessment revealed that most of the criteria were met for all the paradigms, with the exception of “Broad Welfare” and “Happiness Economy”. The latter were found to be mainly non-normative indicator frameworks. As a conclusion, these paradigms were also removed from the selection:

- “Broad Welfare” was removed from the search as being an indicator framework mainly, without a clear normative direction
- “Happiness Economy” was removed from the search as being marked as an indicator framework mainly, without clear normative direction.

Hence, after completing the qualitative and quantitative selection process, a set of 12 paradigms emerged as most suited for further analysis:

1. Green Growth
2. Mission Economy
3. Post Growth
4. A-Growth
5. Doughnut Economy
6. Transition Theory / Great Mindshift
7. Buen Vivir/ Sumak Kawsay
8. Ubuntu Economy
9. Wellbeing Economy
10. Steady State/ Zero Growth
11. Sufficiency Economy
12. Degrowth

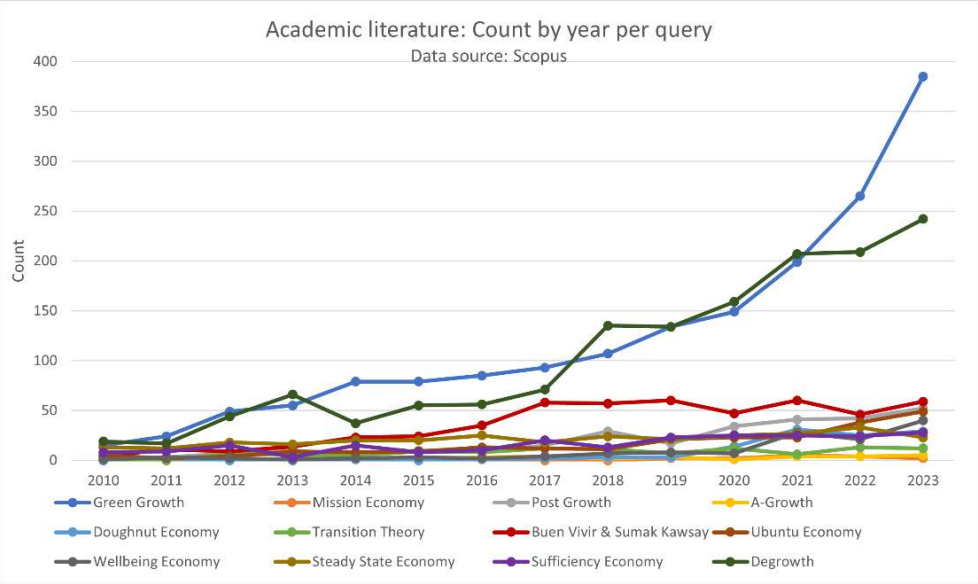
6.3 Step 6 - Mapping the debate about alternative growth paradigms

For the 12 selected alternative growth paradigms, the scientific, policy and public debate were mapped by showing the frequency of publication per year and the geographic origin of these publications. The data sources used are Scopus, SciVal/STIP and GDELT, as outlined in step 3.

Scientific debate

The prevalence of the selected alternative growth paradigms in academic literature from 2010 to 2023 in the Scopus database is shown in Data source: Scopus (2010-2023)

Figure 4. The figure shows that Green Growth is by far the dominant paradigm in terms of scientific publications over these years, with strong growth in the last three years. The second most dominant paradigm is Degrowth, with a steadily increasing body of literature from 2017 onwards. The other paradigms show a more or less stable pattern over the years, with some 50 or less scientific publications per year.



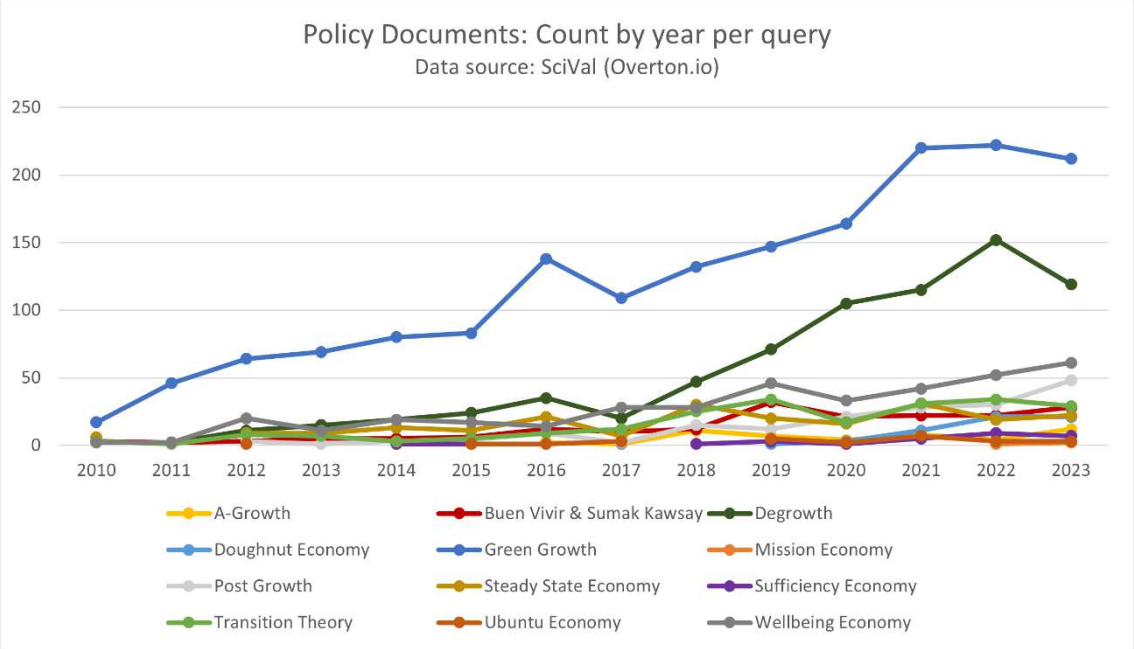
Data source: Scopus (2010-2023)

Figure 4: Academic literature Count by year by alternative growth paradigms.

Policy documents

The prevalence of alternative growth paradigms in policy documents over the years as found in the Elsevier SciVal (Scopus) and EC OECD STIP Compass databases is shown in Figure 5. These are policy documents that are cited, or that are citing academic publications that were collected based on Scopus paradigm searches. The total number of policy documents found was 3,149 after removing duplicates. Out of these documents, there were 77 policy documents (2011-2024) that have a paradigm search keyword mentioned in a title or in an abstract, most of them being policies relating to Green Growth. Policy documents selected for the 'Paradigm grouping' analysis were chosen from this set. The Figure shows a more or less similar pattern as that for the scientific literature, with Green Growth and Degrowth increasingly dominating in policy documents, and the other paradigms with a stable and less prominent pattern.

Data source: SciVal (Overton.io and STIP COMPASS) (2010-2023)



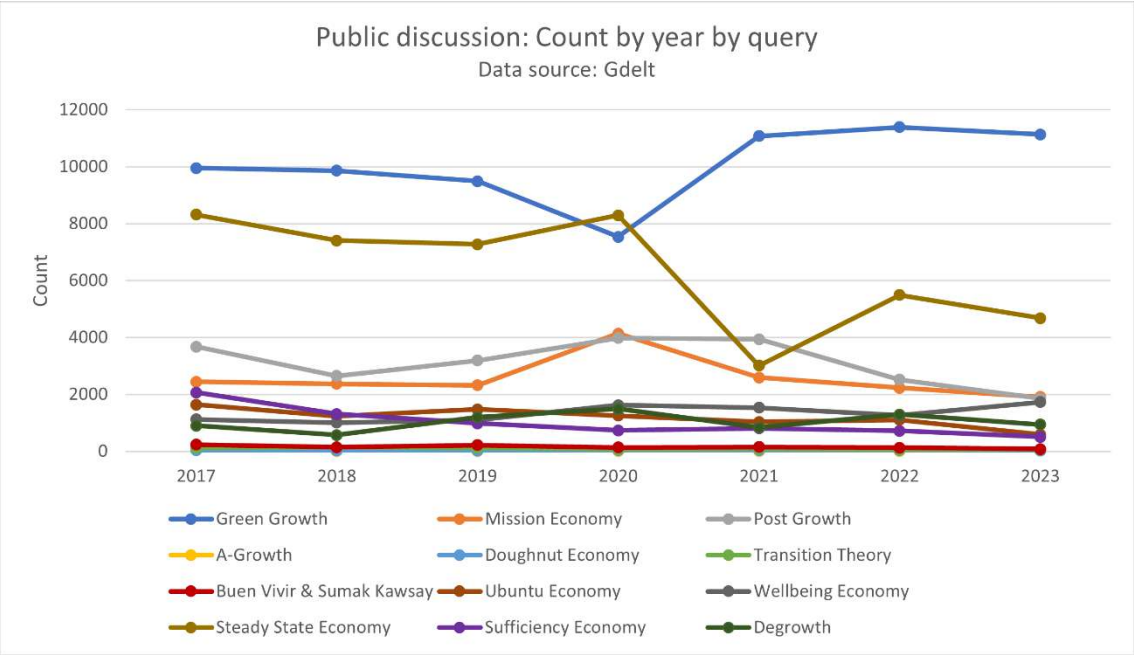
Data source: SciVal (Overton.io and STIP COMPASS) (2010-2023)

Figure 5: Policy documents Count by year by alternative economic paradigm.

More detailed trend charts of the scientific and policy debate are shown in Appendix 1.

Public discussion

The prevalence of alternative growth paradigms in the public discussion from 2017 to 2023 is shown in Figure 7. Here a different pattern is found than in the scientific literature and in policy documents. While Green Growth still dominates the public debate, here the Steady State Economy rather than Degrowth has a higher frequency of publications found. However, the number of documents on the Steady State Economy is declining over the years.



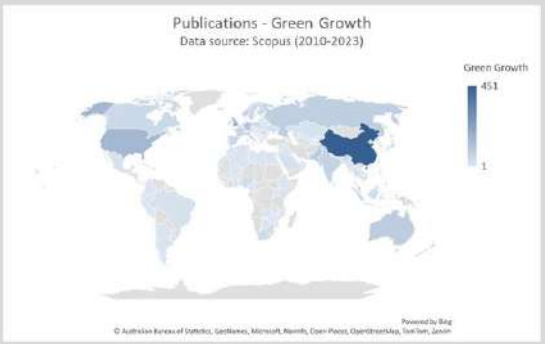
Data source: Gdelt (2017-2023)

Figure 6: Public discussions Count by year by alternative growth paradigm.

Global distribution

For the academic, policy and public discussion, maps were also made of the geographical prevalence of publications for all paradigms separately. These are presented in Appendix 2. Figure 7 shows the geographical distribution of the two most prevalent paradigms, Green Growth and Degrowth, in the academic, policy and public discussion respectively.

Academic discussion

GREEN GROWTH	DEGROWTH
	

Policy discussion

GREEN GROWTH	DEGROWTH
	

Public discussion

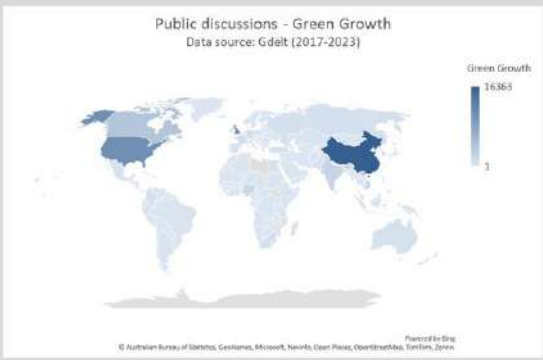
GREEN GROWTH	DEGROWTH
	

Figure 7: Geographic distribution of Green Growth and degrowth publications in the academic, policy and public discussion.

In geographic terms, discussions of Green Growth are particularly prominent in both the US (academic literature and public literature) and China (academic and public literature). Discussions of Degrowth seem confined to the Global West (in terms of both the academic, policy and public literatures). One notable exception is India, where Degrowth seems to be discussed with relative frequency in public sources.

A possible explanation for the trends in numbers and geographic distribution of publications in the scientific, policy and public debate could be that, since its adoption by the OECD and the World Bank in 2011, Green Growth has gained significant popularity in policy making. It is also widely used in academic circles to broadly investigate the relationship between the economy and the environment. Degrowth, a term coined around 2010 or earlier, became more visible in policy literature around 2017. This might be attributed to the annual combined NGO and academic degrowth conferences, which have been organised since the early 2010s and have seen growing participation each year, helping to disseminate degrowth ideas from academia to policy making. Meanwhile, the concept of a Steady State has gained traction in public debate in recent years, often discussed in conjunction with zero growth. Geographically, Green Growth has been an

intergovernmental concept since its adoption by the OECD, UNEP, and the World Bank, while Degrowth initially found a strong academic focus in Spain and Europe.

7 Analysis: examining paradigm features and clustering of paradigms

In this chapter we will discuss research steps 7 and 8 presented in Chapter 2 of this report (See Figure 1).

7.1 Step 7 - Extraction of paradigm features

We conducted a systematic AI based comparison of the paradigms by extracting and synthesising key features from leading academic publications, and from a selected set of policy documents for each of the twelve paradigms that were selected in step 5. By examining these paradigms through a consistent set of features, we aimed to identify commonalities and differences among the paradigms, allowing for a more thorough understanding and comparison of the requirements, goals, and futures they promote.

For the AI analyses, we focused on the scientific and policy literature, as these literature bodies are well suited to the purpose of the analysis. For example, we would expect to find detailed discussion of policy, impacts, requirements, and other paradigm features in this data, whereas the GDELT public discourse data was not found to be a suitable source for such features.

The analysis focused on extracting a set of features in two stages. First, 11 features were extracted in a document level stage from the top 50 cited, accessible scientific publications between 2015 and 2023 for each paradigm, and separately from selected policy documents in the same period, using the Elsevier Scopus database for the scientific documents and Elsevier Scival and EC OECD STIP Compass for the policy documents, respectively. Then, in the aggregation stage, four more features were added that were composed from a combination of the 11 independent features extracted in the document stage.

A general process chart detailing the analytical pipeline developed for the feature extraction analysis of AI paradigm is shown in Figure 8. First, the document contents are converted to numerical format for further analysis using the OpenAI ‘embedding-3-large’ model, which shows particularly strong performance in common benchmarking tests for multi-lingual retrieval, English tasks, and context maintenance. The content for each document is stored in an indexed vector database, which is used in a RAG implementation. For each feature of interest, prompts were iteratively tested and refined. A final set of prompts was then defined for application across the full set of data. In step three, RAG is implemented by applying the feature prompts to relevant information retrieved from the indexed database (representing the document contents), resulting in information extracted along each feature for each document.

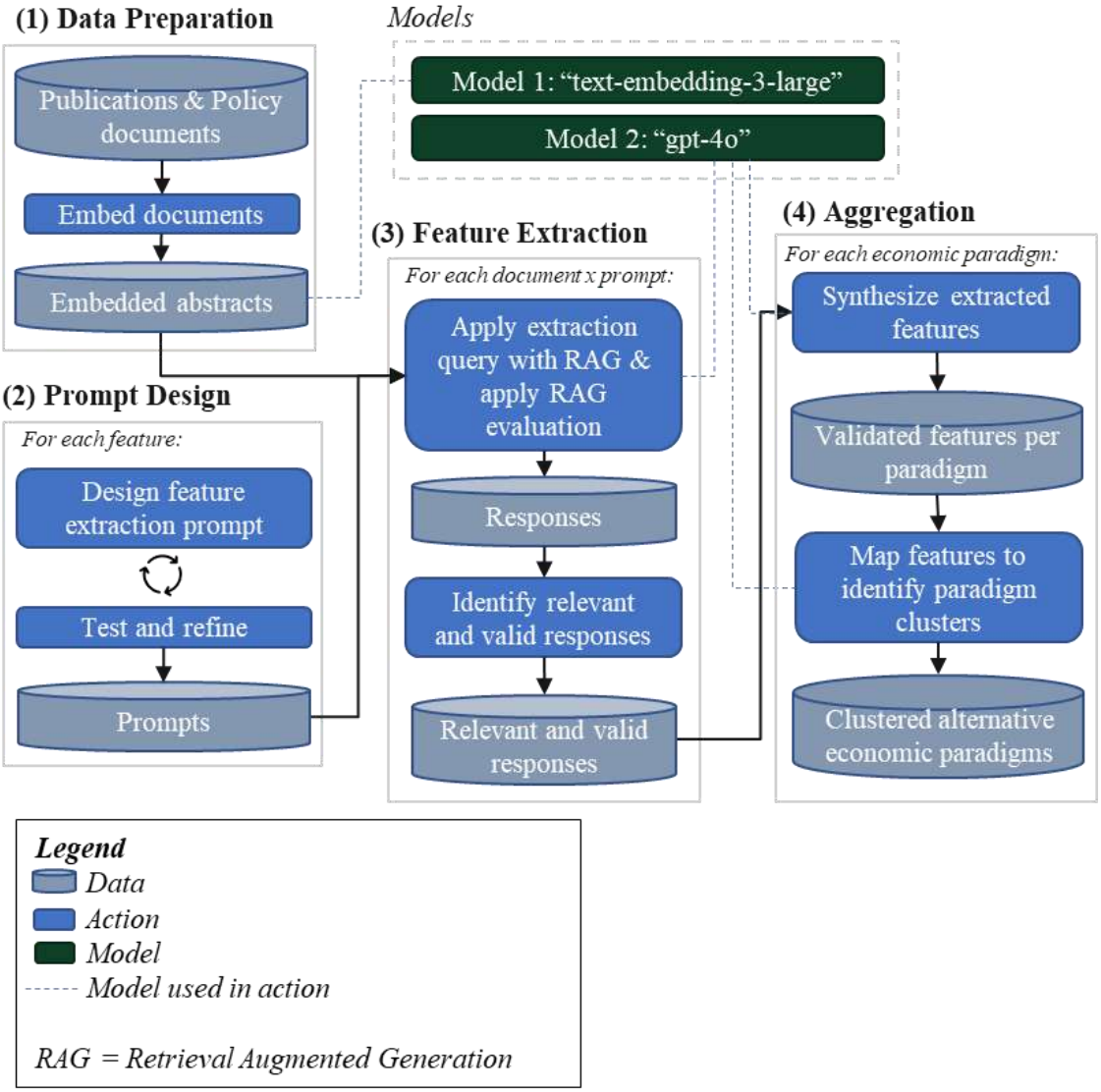


Figure 8: Process chart for LLM-based paradigm feature extraction and synthesis

Validation of the extracted information is carried out according to a common LLM evaluation framework known as the RAG Triad (TruLens, 2024). The RAG Triad tests the RAG implementation and results along three metrics: Answer Relevance, Context Relevance, and Groundedness. Answer Relevance compares the LLM response to the provided prompt, determining whether the LLM's response remained on topic relative to the prompt (i.e., does the response answer the question). Context Relevance compares the provided prompt to the information retrieved from the document (i.e., is there information relevant to the question in the document). Groundedness, also referred to as Faithfulness, compares the response to the information retrieved from the document (i.e., is the answer evidenced in the document).

The validation metrics are then used to determine whether the LLM response should be carried forward to the aggregation step. Based on these metrics, only responses that are both relevant and valid are aggregated. For each paradigm and each feature, the aggregation step collects the relevant and valid document level responses into a new indexed vector database and again applies RAG, using a second feature prompt similar to the document level feature prompt, but

modified for aggregation rather than extraction. The RAG Triad metrics are applied to these responses for final validation.

The final output of the analysis is a set of summaries synthesising information from the policy or publication documents along each feature for each paradigm. This information is then further analysed to determine similarities, differences, and patterns among the paradigms for categorization and clustering of the paradigms, and to map them along the aspects surfaced in the features.

Paradigm features results

The selection of paradigm features to be extracted in the document stage was based on the qualitative analysis done prior to this project (Slingerland et al., 2024). In that research, the following features were found to be important to differentiate between paradigms: position towards respectively 'GDP / economic growth'; 'norms, values and behavioural change'; 'technological innovation'; 'redistribution' and 'key scaling actor'. In order to make use of the potentials of the AI analysis, it was decided to add the following additional features to the extraction, in line with the Grant Agreement: the descriptive features 'summary', 'definition' and 'goals', the general theory of change related features 'policies (future)', 'actions (past) and 'indicators', the impacts related features 'impacts on planetary boundaries' and 'impacts on society', and finally the analytical features 'paradigm limitations' and 'paradigm strengths' (Table 7).

OVERALL DESCRIPTIVE FEATURES	THEORY OF CHANGE RELATED FEATURES (GENERAL)	THEORY OF CHANGE RELATED FEATURES (SPECIFIC)	IMPACTS RELATED FEATURES	Analytical features
• Summary • *Definition* • Goals	• Policies (future) • Actions (past) • Indicators	• GDP / economic growth • Norms, values and behavioural change • *Technological innovation* • *Redistribution of wealth* • Key scaling actor	• Impacts on planetary boundaries • Impacts on society	• Paradigm limitations • Paradigm strengths

Features that were composed in the aggregation stage from a combination of the independent features in *italics*

Table 7: AI extracted paradigm features for the 12 selected paradigms

The eleven independent features extracted in the document stage of the extraction were: "Summary"; "Norms, Values, and Behavioral Change"; "Policy Instruments and Actions (Future)"; "Concrete Actions (Past)"; "Limitations"; "Strengths"; "Role of GDP"; "Key Scaling Actor (Top Down / Top Bottom)"; "Impacts on Environment / Planetary Boundaries"; "Impacts on Society"; and "Indicators". Each of these features were synthesised across responses.

Four additional features were included at the aggregation stage, as they could be derived from the 11 document level features without the need for additional document level queries. This contributed computational, and thus resource, efficiencies to the analysis, as the document stage is more computationally intensive than the aggregation stage. "Definition" (derived from "Summary"); "Goals" (derived from "Impacts on Environment / Planetary Boundaries", and "Impacts on Society"), "Role of Technological Innovation" (derived from "Summary", "Policy

Instruments and Actions", and "Impacts on Environment / Planetary Boundaries"); and "Redistribution of Wealth" (derived from "Summary", "Policy Instruments and Actions (Future)", and "Impacts on Society"). The prompts used to extract information along each of these features as well as a technical description of the AI process chart can be found in Appendix 3.

Detailed features of all paradigms can be found in the accompanying Excel sheets

1. *AI Analysis - Publications (Paradigm features found in scientific literature)*
2. *AI Analysis - Policy (Paradigm features found in policy documents)*

Analysis of features

When looking in more detail at the data produced on specific features from the AI analysis, the wealth of information extracted is evident. This leads to large overlaps between paradigms in many features, making it difficult to distinguish between them in an absolute sense. For the scientific literature, documents were identified and collected for all paradigms, but for the policy literature documents could be identified for only six paradigms: Green Growth, Post Growth, Buen Vivir, Wellbeing Economy, Great Mindshift/ Transition Theory and Degrowth. The information on features for these paradigms in the scientific literature is very similar to that of the policy literature, therefore the latter source is only mentioned when clearly different from the former.

Despite the overlaps between paradigm features in the literature, different focus points per paradigm can be recognised when looking into each feature separately. Some main observations in this respect include:

Goals

In the analysis of scientific literature, almost all paradigms include general statements about sustainable and human development. Some gradual differences in goals between paradigms are that Green Growth and Mission Economy mention goals like 'sustainable and inclusive economic growth', 'resource efficiency' and 'shaping markets to socially desirable outcomes'. Post Growth goals include 'cultural shifts', 'sustainable lifestyles' and 'new institutional frameworks'. Doughnut Economy stresses, e.g., 'meeting human needs within planetary boundaries' and 'agnosticism about growth'. Transition Theory mentions aiming at 'disrupting and transforming existing organisational structures and mindsets'. Buen Vivir goals include 'plurality, harmony and cultural preservation'. Degrowth includes 'social and economic reorganisation' and 'cultural and value shift'.

Policy instruments

Each paradigm promotes a varied set of policy instruments. For Green Growth and Mission Economy these include, for instance, technological innovation and market creation, for Post Growth and Degrowth, work time reduction, basic incomes, resource and income caps and voluntary simplicity. Transition Theory promotes support for niche innovations, while Buen Vivir supports integrating indigenous knowledge systems and community and food sovereignty. Wellbeing Economy supports the installation of wellbeing budgets and the Steady State Economy stresses population control as one of the instruments to achieve its goals.

Indicators

Fitting with goals and policy instruments that are promoted, there is a wide range of indicators proposed by the paradigms. Partly these align with the goals, such as measuring environmental taxes, technological innovation and foreign direct investment, which fit with environmental objectives for Green Growth and Mission Economy, or measuring resource throughput and employment for Post Growth and Degrowth. However, there are also many less conventional indicators proposed by the paradigms, such as 'boldness and inspirational value' of goals in Mission Economy, 'transition phases' and 'technological adoption capacity' for Transition Theory and 'male - female complementarity', 'cultural satisfaction' and 'horizontal state structure' for Buen Vivir.

Impacts on planetary boundaries

All paradigms emphasize the need to mitigate climate change and stay within planetary boundaries. Differences between paradigms only emerge in their preferred impact pathways. For example, Green Growth emphasizes the need to decouple economic growth from environmental degradation, while Degrowth and Post-growth emphasize the need to reduce the risks of technology-driven pathways, such as large-scale carbon capture, by reducing consumption and the demand for production. Relations between planetary boundaries and social goals are made by many paradigms, such as the highlighting of energy justice and localised production by for instance the Wellbeing Economy, Ubuntu and Degrowth, or stressing the double social and environmental boundaries by the Doughnut Economy.

Impacts on societies

While all paradigms appear to aim for the same overall goals in terms of overall impacts on planetary boundaries, more profound differences between the paradigms are found in their preferred impacts on societies. Green Growth aims t at economic growth and environmental sustainability, while Post Growth and Degrowth want to reach a sustainable and equitable society by moving away from a priority on economic growth. Furthermore, several paradigms stress the quality of life as an important impact on societies to be obtained, while a harmonious coexistence with nature and cultural preservation are highlighted in particular by Buen Vivir. Also, a variety of instruments are mentioned as preferred routes towards societal impact. For instance, Mission Economy mentions a pro-active and entrepreneurial state as one of the envisaged routes towards change, Transition Theory the 'multilevel perspective' and 'strategic niche management', and the Steady State Economy population control.

Role of GDP

The views on the role of GDP as an indicator for social welfare vary between 'a core indicator for economic development' (e.g. Green Growth), 'indifferent (e.g. A-Growth, Doughnut Economy, Steady State Economy) and 'to be minimised' (e.g. Buen Vivir, Ubuntu and Degrowth). The Wellbeing Economy sees GDP growth as one indicator in a wider dashboard for wellbeing.

Norms, values and behavioural change

All paradigms have some kind of claim to norms and values change. However, Green Growth sees such change as conditional on 'reducing environmental degradation, without hindering economic growth' and Mission Economy states that this change would need to be 'aligned' with its Moonshot Missions. Post Growth, Degrowth and other paradigms rather envision more fundamental norms and values change leading to emphasising sustainability over economic growth, with a focus to change consumerism to more general wellbeing and social equity. Other specific directions for norms and value change mentioned by paradigms include sharing,

simplicity, moderation, reasonableness, resilience, self-reliance, convivial relationships, frugality, democracy and collective wellbeing.

Redistribution of wealth

Green Growth aims for limited redistribution of wealth as long as it does not slow down economic growth, in particular under the heading of 'inclusive Green Growth'. Mission Economy strives for equitable sharing of resources and ensuring access to essential services, in particular health care. Most other paradigms see redistribution as an essential element of their overall goals, claiming that satisfaction of basic needs for all can be achieved through better distribution of wealth rather than to increasing overall wealth.

Technological innovation

Green Growth sees a crucial role for technological innovation in transforming economic and industrial structures towards sustainability. Other paradigms have a more critical perspective towards technological innovation, for instance stressing the need for a 're-evaluation to ensure it aligns with sustainability and social equity (Post Growth). Under various names, a different future role of technological innovation in future societies is proposed that stresses the role of such innovation for general wellbeing in societies. Terms used are 'convivial innovation' (Post Growth, Degrowth), 'frugal innovation' (minimising resource use, Degrowth) and 'technovation' (Wellbeing Economy). Transition Theory advocates 'strategic niche management' to foster in particular small-scale and bottom-up technologies.

Key scaling actor

Governmental policies are mentioned by most paradigms as the key driver for change. Some paradigms see governments together with other stakeholders such as businesses and citizens responsible for change. Degrowth stresses the role of citizens and grassroots organisations. However, some Degrowth sources see the government as the main actor in change, as can be seen in Figure 9. For this feature, scientific literature and policy literature diverge. Where scientific literature stresses a top-down role for government in most paradigms, in policy documents many paradigms show a tendency of greater importance attached to other actors, such as businesses and citizens.

Strength and weaknesses of paradigms

The AI analysis also points to several weaknesses and strengths of the paradigms.

Weaknesses

Particular weaknesses of several paradigms are the risk to result only in rhetoric and window dressing rather than in concrete action. The risk of misappropriation by influential groups and interests in society, and implementation difficulties in particular regarding changes in behaviours, norms and values aimed at are also mentioned. Also, for several paradigms, it is mentioned that public, political and business support for change are an issue. More specific weaknesses mentioned for individual paradigms include the dependence on technological innovation and the uncertainties about such innovation leading to decoupling for Green Growth; a control bias and information gaps in the Mission Economy; fiscal, welfare, investment and productivity issues in Post Growth; complex trade-offs between goals in the Doughnut Economy; and overlooking power relations and politics in Transition Theory.

Strengths

All paradigms stress several strengths of their vision. Often a statement is made about empirical evidence of successful implementation in the past, like Mission Economy mentioning its track

record regarding the Apollo Mission in the 1960s, or Transition Theory stressing its successful application in several case studies. Green Growth points to its global recognition as shown by its application by several multilateral organisations and in many countries. Green Growth furthermore stresses its particular alignment of environmental protection and economic growth. Post Growth and several other paradigms focus on quality of life and A-Growth on its midway position between Green Growth and Degrowth. Other specific strengths mentioned by a variety of paradigms are empowerment, local economic development, reduced inequality, community and commons, cultural alignment and a holistic approach.

7.2 Step 8 - Analysis of paradigm taxonomies

Following the same axes as in the a priori taxonomy ('change in norms and values' and 'key scaling actor' respectively), we then applied the AI model to assign relative placements of each paradigm along these axes. This is done separately for the policy literature and for the scientific literature (See Figure 9 and Figure 10).

The assignment of each paradigm relative to the others was performed by applying a specified prompt to all aggregate level results for the given feature using OpenAI's "gpt-4o" model. This allowed for assignment of each paradigm along the feature axis with the context of other paradigms. The prompts used to derive the relative placement of each paradigm along these axes are provided in the Clustering Prompts table in Appendix 4.

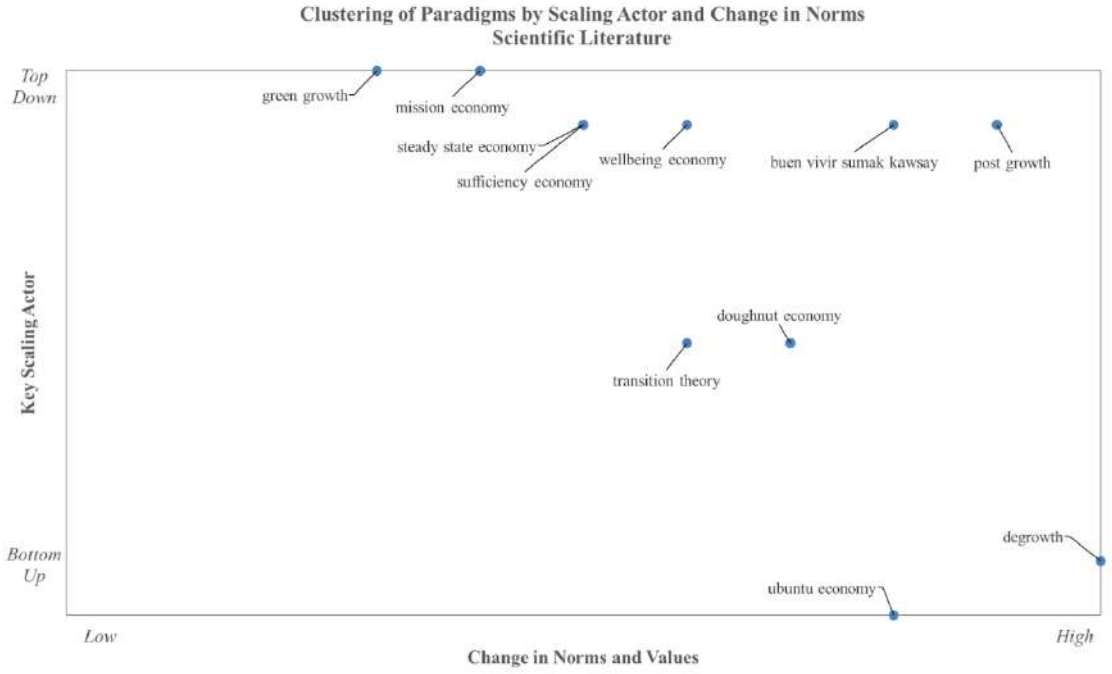


Figure 9: Clustering of paradigms based on variables norms/values change and key scaling actor - Scientific literature

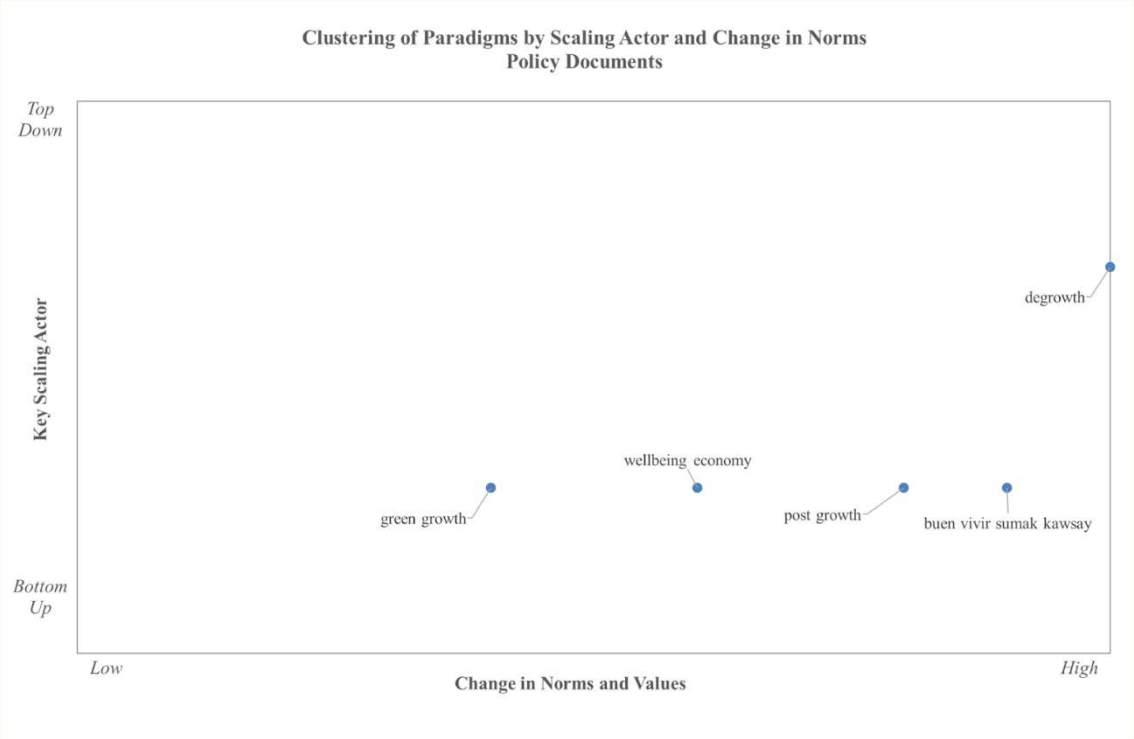


Figure 10: Clustering of paradigms based on variables norms/values change and key scaling actor – Policy documents

The main observations regarding the AI based clustering of the paradigms toward the taxonomy in Figure 9 (scientific literature) are:

- 11 out of 12 paradigms scanned are included in the taxonomy. Only A-growth is excluded because the AI analysis did not reveal information on the key scaling actor (value 0 for this feature);
- Most paradigms in this analysis tend towards top-down (primarily governmental) scaling approaches;
- Post-growth and Degrowth, as well as Buen Vivir and Ubuntu, emerge as very different in the 'key scaling actor' feature (respectively very top-down and very bottom-up);
- Most paradigms, including Green Growth, tend towards norms and values change.

Main observations regarding the AI based clustering of the paradigms toward the taxonomy in Figure 10 (policy documents) are:

- Six out of 12 paradigms are included in the policy document analysis, as no documents were found for the remaining paradigms under the policy document search design. Five of these six paradigms are included in the taxonomy. For Great Mindshift, the value for 'key scaling actor' was zero, meaning that the AI analysis did not reveal information about this particular feature;
- Apart from Degrowth, all shown paradigms tend towards a bottom-up approach for 'key scaling actor';
- Most paradigms, apart from Green Growth, tend towards norms and values change.

Comparing observations from Figure 9 and Figure 10, the following remarks can be made:

- The relative classifications of paradigms towards the variables policy and scientific literature are quite different in their ranking towards the feature ‘key scaling actor’, but quite similar as to the feature ‘norms and values change’.

In chapter 6 (step 9) the information provided by these two AI analyses is combined with the information from the initial qualitative analysis prior to this project in order to make decisions as to a final taxonomy proposed for further work in the MultiFutures project.

8 Synthesis: from paradigms to storylines

In this chapter we will discuss research steps 9 and 10 presented in Chapter 2 of this report, covering respectively the integration of the AI analyses and the qualitative taxonomy, and the formulation of alternative growth storylines for the MultiFutures project.

8.1 Step 9 - Integrating AI-based and qualitative taxonomy of paradigms

Comparing the initial paradigm set used as an input for WP1 with the final selected paradigm set as a result of the WP1 analysis, several observations can be made:

- As a result of the combined quantitative/qualitative selection process, the seven initial paradigms were replaced by 12 new paradigms (Table 8)
- The initial and new paradigm selection overlap to a large extent, but there are also some differences: Broad Welfare as an initial paradigm was excluded, as it did not show up in the international AI search of literature, while Post Growth, A-Growth, Ubuntu, Wellbeing economy, Steady State/ Zero Growth and Sufficiency Economy were added as new paradigms that appeared from the keyword search.
- The links between Transition Theory and Great Mindshift, Buen Vivir and Sumak Kawsay as well as between Steady State and Zero Growth were made explicit by combining them as equivalents and regarding them as one paradigm.

INITIAL ALTERNATIVE GROWTH PARADIGMS USED AS INPUT FOR MULTIFUTURES	FINALLY SELECTED ALTERNATIVE GROWTH PARADIGMS FOR FURTHER STORYLINE AND SCENARIO DEVELOPMENT IN MULTIFUTURES
1. Green Growth	1. Green Growth
2. Mission Economy	2. Mission economy
3. Degrowth	3. Degrowth
4. Doughnut Economy	4. Post growth
5. Broad Welfare	5. A-growth
6. Great Mindshift	6. Doughnut economy
7. Buen Vivir	7. Transition theory/ Great Mindshift
	8. Buen Vivir/ Sumak Kawsay
	9. Ubuntu economy
	10. Wellbeing economy
	11. Steady state/ zero growth
	12. Sufficiency economy

Table 8: Initial and final paradigm set in WP1

- Eleven paradigm features were included in the AI analysis: Goals; Policies (future); Actions (past); Indicators; GDP / economic growth; Norms, values and behavioural change; Technological innovation; Redistribution of wealth; Key scaling actor; Impacts on planetary boundaries, and; Impacts on society.
- For each of the features, detailed but expansive information is extracted in the AI analysis. This makes explicit distinctions between the different paradigms intensive to uncover.
- Paradigm features are used for constructing key elements of the MultiFutures storylines.

Theories of change of paradigms

The theories of change of the paradigms can be identified as systematic steps going from policy inputs to policies, outputs of policies, outcomes and final intended impacts of the paradigms. Steps that the AI analysis assisted in identifying are 'policies', 'impacts on planetary boundaries' and 'impacts on societies'. The results of this analysis show that differences in these paradigms can be found not so much in their environmental goals, as all paradigms (albeit with different intensities) strive to reduce climate change and stay within planetary boundaries. Rather, differences between paradigms are to be found in their societal goals. Roughly, these can include more or less stress on environmental justice and redistribution, and on changing norms, values and behaviours of people. Important differences are also found in their preferred routes towards change, e.g. including economic growth or not, reducing material throughputs in society or not and aiming at stabilisation of population or not.

Taxonomy

Looking more specifically into the AI based taxonomy of scientific literature and policy documents, and comparing those with the initial taxonomy at the outset of this project (Table 9) further key observations emerge:

- In all three cases, the degree of norms and values shift in policy making and the degree of direct government steering in transition processes are used as main independent variables (x and y-axes). Extreme positions in all three taxonomies are 'current norms and values as a basis for transition' versus 'norms and values shift as a precondition for transition' (x-axis) and 'top-down', i.e., direct governmental steering versus 'bottom-up', i.e., other stakeholders leading in transition (y-axis).
- Differences between the two taxonomies based on the WP1 analysis and the initial taxonomy are particularly stark regarding the relative placement towards government steering (y-axis). Green Growth for instance is classified as very top-down in the AI scientific literature taxonomy, but was ranked bottom-up in the initial taxonomy. Similarly, Degrowth is marked as bottom-up in the AI scientific literature taxonomy and as top-down in the initial taxonomy.
- The AI-based policy document analysis is more aligned with the initial taxonomy than the scientific literature base analysis. In line with the initial taxonomy, Green Growth is ranked as more bottom-up, and Degrowth is ranked as more top-down.

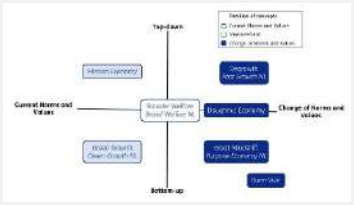
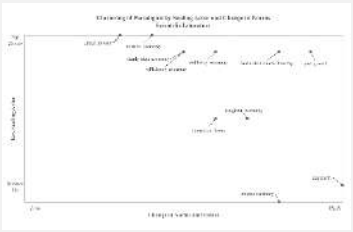
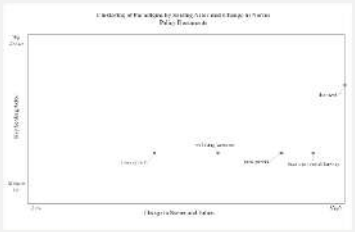
INITIAL TAXONOMY OF PARADIGMS USED AS INPUT FOR MULTIFUTURES WP1 (SEE SOURCE: SLINGERLAND ET AL., 2024 FIGURE 2)	AI BASED TAXONOMY OF SELECTED PARADIGMS - SCIENTIFIC LITERATURE ANALYSIS (SEE FIGURE 9)	AI BASED TAXONOMY OF SELECTED PARADIGMS - POLICY DOCUMENT ANALYSIS (SEE FIGURE 10)
		

Table 9: Initial taxonomy and AI-based taxonomies of scientific literature and of policy documents

A possible conclusion that might be drawn from these observations is that ranking of the paradigms, in general, might not be 'absolute', but rather context dependent: Green Growth seen

in a context of current policy documents shows more bottom-up than analysed in a scientific literature context.

Another possible explanation that could account for the differences found between the three taxonomies is that definitions of what is considered as 'bottom-up' or 'top-down' might be different. In the initial analysis, Green Growth was for instance classified as 'bottom-up' since market actors are the main stakeholder to cause change after the playing field has been set by the government. Nevertheless, setting this playing field at the beginning also involves substantial governmental action. This could also be regarded as 'top-down'.

Given the discrepancies between the three taxonomies, it was concluded that a final taxonomy would require a normative decision as to which definition to use for 'top-down' and 'bottom-up'. It was decided to follow the initial interpretation of these terms, regarding Green Growth as a 'bottom-up' rather than a 'top-down' paradigm, since in the end market stakeholders determine the direction of transition after borders have been established to that market by the government's decision on how to internalise externalities.

That interpretation led to a final proposed taxonomy of paradigms as in Figure 11. In this figure, all 12 alternative growth paradigms are assigned to one of the four quadrants and ranked qualitatively on their relative positions towards government steering and norms and values change, thereby using information from the three taxonomies made. Subsequently, each quadrant was given a title based on one of the paradigms in the quadrant that was considered representative and clearly distinctive from the other quadrants (Table 9).

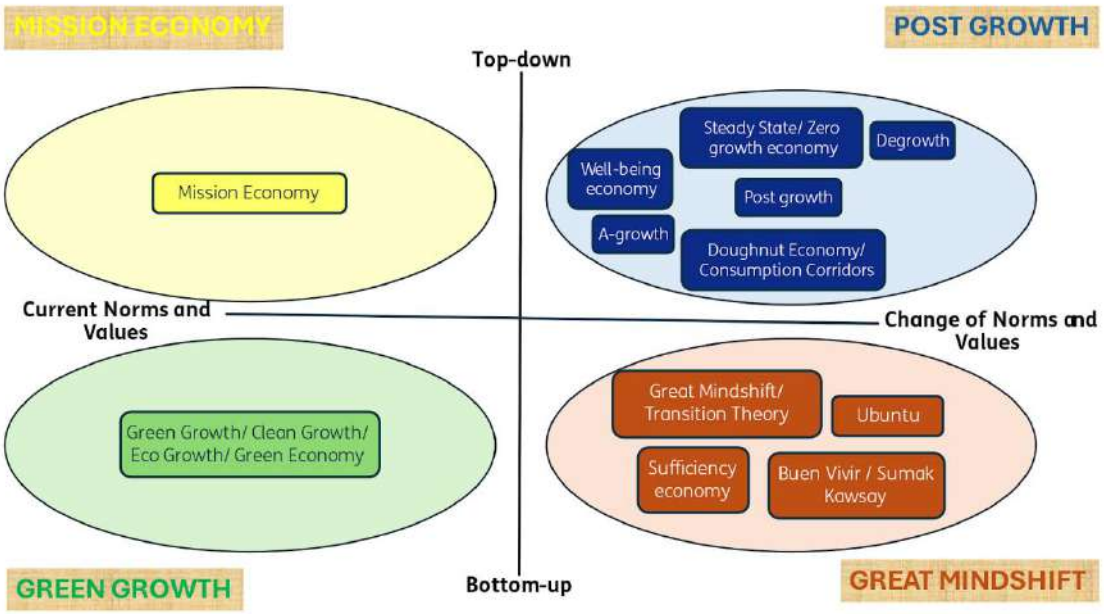


Figure 11: Proposed taxonomy of alternative growth paradigms for use in the MultiFutures project

8.2 Step 10 - Determining storylines for MultiFutures scenarios

The quadrants in Figure 11 are the basis for four distinctive storylines of policy scenarios that each aim to reach sustainability targets in different ways, with different policy routes and also different interpretations of the 'ideal' final society that has to be achieved. The storylines are:

1. Green Growth (Comb) - GGC
2. Mission Economy (Comb) - MEC
3. Post Growth (Comb) - PGC
4. Great Mindshift (Comb) - GMC

Each of the four storylines was assigned characteristic features, based on the key features of the underlying paradigms extracted in research step 7 (see Table 7). In particular the features 'guiding principles (goals)', 'key scaling actor', 'position towards GDP', 'norms and values change', 'technological innovation', 'redistribution of wealth', as well as some characteristic policies were found useful to distinguish the four storylines (Table 10).

	1. GREEN GROWTH_COMB	2. MISSION ECONOMY_COMB	3. POST GROWTH_COMB	4. GREAT MINDSHIFT _COMB
Combination of paradigms	Green Growth/ Clean Growth/ Eco Growth/ Green Economy (seen as equivalents)	Mission Economy	Post Growth, Degrowth, A-Growth, Wellbeing Economy, Steady State/ Zero Growth Economy, Doughnut Economy/ Consumption Corridors (seen as different paradigms in the same family)	Great Mindshift/ Transition Theory, Buen Vivir, Ubuntu, Sufficiency Economy
Guiding principles (goals)	Internalisation of externalities in market prices with the aim to achieve decoupling for climate goals or all planetary boundaries	Direct technology choices and governmental action to achieve climate goals or planetary boundaries	Strong norms, values and behavioural policies to achieve planetary boundaries combined with national and international (North/South) redistribution policies	Strong norms, values and behavioural shifts to achieve planetary boundaries, with a focus on stimulating own initiative. Focus on bottom-up technological innovation, decentralisation, self-sufficiency, local governance and economies
Key scaling actor	Market parties determine the direction of innovation after Government has set market borders to internalise externalities	Government chooses technologies to achieve planetary boundaries and develops detailed implementation plans (direct regulation)	Government sets direct regulation for norms, values and behavioural shift, determines macro-economic reform policies (reduced working hours, North-South redistribution)	Enlightened entrepreneurs and citizens determine bottom-up innovation directions, decentralised policy making within countries
Position towards GDP	GDP growth is required to finance environmental measures	GDP growth is required to finance technological innovation for societal missions	GDP growth or degrowth is the result of achieving planetary boundaries and social goals	GDP growth or degrowth is the result of achieving planetary boundaries and self-sufficiency goals

	1. GREEN GROWTH_COMB	2. MISSION ECONOMY_COMB	3. POST GROWTH_COMB	4. GREAT MINDSHIFT _COMB
Norms, values and behavioural change	Current norms and values are not influenced by policy making. Limited/ no behavioural change policies	Current norms and values are hardly influenced by policy making. Limited behavioural change policies	Changing current norms, values and behaviours towards more ecocentric views with strong governmental policies is considered a prerequisite for achieving planetary and social targets	Changing current norms, values and behaviours towards more ecocentric views and a focus on self-sufficiency is considered a prerequisite for achieving planetary and social targets
Technological innovation	Technological innovation is strongly stimulated with general, technology-neutral financial instruments	Technological innovation is strongly stimulated by direct governmental technology choices and instruments	Technological innovation is stimulated with a clear preference for local, small scale technologies and public/citizen ownership	Technological innovation is stimulated with a clear preference for local, small scale technologies and public/citizen ownership
Redistribution of wealth	There is no North/South wealth redistribution. Within countries there is limited wealth redistribution	There is no North/South wealth redistribution. Within countries there is limited wealth redistribution	There are strong North/South redistribution policies and redistribution policies within countries	Local governments redistribute wealth within their own areas
Characterising Policies	- Market creation for planetary boundaries, ETS like market systems - Open markets, globalisation - General technological innovation policies - Net zero carbon	- National governmental missions, direct regulation to achieve missions	- Strong norms, values and behavioural change policies - Progressive consumption tax - International and national redistribution policies - Working time reduction policies, basic income, inclusion of informal sectors (care) in economy	- Strong norms, values and behavioural change policies based on voluntary nudging rather than enforcement - Niche innovation policies - Strong decentralisation and local self-sufficiency policies, transition towns - Zero fossil, reducing extraction policies, resource caps - Citizen participation

	1. GREEN GROWTH_COMB	2. MISSION ECONOMY_COMB	3. POST GROWTH_COMB	4. GREAT MINDSHIFT _COMB
			- Zero fossil use, reducing extraction policies, resource caps - Citizen participation	- Cultural and indigenous rights, rights for nature

Table 10: Key features of proposed storylines for MultiFutures scenarios

Writing out the features presented in Table 10 in a coherent way results in the following four alternative growth storylines proposed as a basis for the policy scenarios to be further developed and modelled to examine their potential impacts in the subsequent work packages in the MultiFutures project.

Note that the storylines as described here are different, qualitative pathways to sustainable societies. They do not yet describe fully fledged scenarios with detailed sectoral policies and quantitative figures that can be used directly as inputs for quantitative modelling of potential societal, environmental, and other impacts. These will be developed in subsequent activities in MultiFutures.

Proposed storylines for MultiFutures:

- **Green Growth (Combined) storyline**

In the Green Growth storyline, the government sees the market as the main vehicle for transition towards a sustainable world. Internalising environmental externalities in market prices is the key mechanism for setting the borders to market actions in such a way that it provides the right incentives for realising environmental goals. Most probable sustainability goals to be set in the Green Growth storyline are the current climate change goals leading to a maximum of 1.5 degrees climate change. However, also more ambitious sustainability goals aiming to meet the Rockstrom planetary targets (Steffen, 2015) could be imagined in this storyline. The goals are formulated in a market based way, e.g., 'decarbonising' rather than 'de-fossilising'. Market based instruments are also seen as the key way to realise these targets, in particular trading systems like the current EU Emissions Trading Scheme for greenhouse gas emissions. These would be developed also for the other (non-climate) planetary boundaries suggested by Rockstrom (ibid.) if a planetary boundaries goal was to be formulated. Another key policy instrument in this storyline is generic support for technological innovation, stimulating such innovation in general without making choices between technologies. In this storyline, GDP growth is seen as necessary to finance the realisation of sustainability and other societal targets and is a key indicator for the success of governmental policies. The Green Growth storyline imagines a future society as largely based on current behaviours, norms and values. Individual behavioural freedom is a key aspect in such a society, in which the government should try to influence or limit as little as possible. Redistribution of wealth within countries might be pursued but it is overall seen as less important and sometimes even as detrimental to efficient innovation. Redistribution of wealth on a global scale is hardly or not at all addressed.

- **Mission Economy (Combined) storyline**

In the Mission Economy storyline, the government formulates societal 'moonshot' missions in which ambitious goals are set for societal issues that the government considers in need to be urgently solved. One such goal could be 'solving climate change', but a formulation in terms of 'staying within planetary boundaries' would also be possible. Once the goal of such a mission is formulated, the government would also develop very detailed plans to realise the goal. This also includes governmental choices regarding the kind of technological innovation to be pursued, i.e. industrial policy involving a-priori selection of the specific technologies to be stimulated. 'Decarbonising' rather than 'de-fossilising' seems likely in a Mission Economy, like in Green Growth. The government uses a mix of direct regulation and market based instruments to achieve its goals, and closely monitors and enforces progress toward these goals. GDP growth is seen as a prerequisite to achieve the missions' goals. A future society is seen as largely based on current behaviours, norms and values, without many limitations to individual freedoms. Substantial redistribution of wealth within or between countries do not seem likely as goals in a Mission Economy.

- **Post Growth (Combined) storyline**

In the Post Growth storyline, there is a strong focus on the direct steering role of the government regarding environmental and social goals for reaching societal welfare. A 'wellbeing' dashboard of indicators and accompanying budgets are developed for this purpose. Environmental goals are likely to be based on intensified efforts towards staying within all planetary boundaries rather than to reach climate change targets only. What is considered to be a 'just' redistribution of wealth within and between countries is an essential part of the social goals in the Post Growth storyline. Economic growth, or not, is seen as a subordinate outcome of striving for these environmental and social goals. Hence, structural changes in society that might lead to strong economic decline in some sectors are seen as justified. This might include de-fossilising, leading to a quick phase out of fossil industry, and phasing out of other industries that are considered to be too polluting. Nudging change of current norms, values and behaviours by the government is seen as an essential precondition for successful sustainability policies. A progressive 'consumption tax', taxing the consumption of goods and services based on their environmental performance, is an important instrument here, which might be accompanied by a reduction of taxes on labour as compensation. Other important structural changes in society are a basic income for all, a drastically shortened working week, and the inclusion of voluntary care work in the economic system. Technological innovation is seen as important, but should be pursued on an open-access basis. The democratic system would be reformed to include more public participation in decision making, e.g. by local and national citizen councils that would co-decide together with policy makers on key policy issues. Probably also the financial system would be reformed to reduce profits in the monetary - not directly material asset based - economy.

- **Great Mindshift (Combined) storyline**

In the Great Mindshift storyline, national governments reform themselves to give more executive power to decentral authorities, e.g., municipalities. The focus of the economy shifts to local self-sufficiency and autonomy, with the development of 'Transition Towns' as a guiding principle. Ambitious environmental and social targets are pursued by local authorities, with GDP figures as a subordinate outcome of policies towards these targets. Planetary boundaries are likely to be set, with zero fossil, reduced extraction and resource caps as likely policies. Norms and values change are strongly stimulated, however with a focus on nudging rather than on enforcement. Local niche entrepreneurs and enlightened citizens as bottom-up frontrunners lead the way towards these norms and values change. Bottom-up participation of citizens in policy making is a key aspect of the Great Mindshift storyline. Indigenous knowledge and rights, as well as rights for nature are strongly valued. Furthermore, redistribution of wealth on a local level, as well as global redistribution between poorer and richer communities are important.

9 Discussion

In this chapter we will discuss the main research steps and the research method applied.

9.1 Limitations and opportunities of the research process

The research process led to three main outputs:

- A selection of alternative growth paradigms
- An analysis and comparison of key features of these paradigms
- A grouping and taxonomy of the selected paradigms, based on the analysis of the key features
- Description of four qualitative storylines of grouped paradigms that can be used as storylines for further quantitative scenario development, including formulation of key inputs for modelling.

The selection process consisted of a divergence-convergence design approach that started out with an initial set of paradigms and a taxonomy derived from previous research. This process consisted of a combination of quantitative and qualitative steps that are outlined in Table 11.

STEP NR	STEP TITLE	ACTION	AI OR QUAL	RESULT	NUMBER OF INPUT PARADIGMS	NUMBER OF OUTPUT PARADIGMS
1	Determining initial paradigm set and taxonomy	Starting out with seven paradigms and initial taxonomy from previous project "Analysing the Beyond Growth Debate" (2024). Paradigms: Green Growth, Mission Economy, Degrowth, Doughnut Economy, Broad Welfare, Great Mindshift, Buen Vivir.	Qual	Seven paradigms with initial paradigm taxonomy	0	7
2	Expanding paradigm set	Questionnaire to consortium. Additional keyword discovery via scientific literature, policy documents and public data search.	Qual / AI	41 keywords as potential new paradigms	7	41
3	Collecting and exploring data	AI keyword exploration and policy data search for	Qual / AI	4 paradigms deselected (Great Mindshift, Good Life	41	37

STEP NR	STEP TITLE	ACTION	AI OR QUAL	RESULT	NUMBER OF INPUT PARADIGMS	NUMBER OF OUTPUT PARADIGMS
		selecting final paradigm set		Economy, Sustainable Growth, Sustainable Economy);		
4	Setting the criteria for paradigm set	Developing selection criteria for paradigms	Qual	Selection criteria	37	37
5	Selecting final paradigm set	Applying selection criteria to the selected input paradigms by AI and qualitative selection of paradigms	Qual / AI	12 finally selected paradigms by applying criteria and joining equivalents	37	12
6	Mapping the academic and policy debate	Analysis of frequency and geographical spread of selected paradigms (scientific literature, policy documents, public data)	Quant (biblio/stat)	Figures with frequency of selected paradigms, maps of paradigms	12	12

Table 11: Summary of selection process steps

A key limitation of the *selection process* was that it involved several normative decisions by the project team, for instance on the selection criteria to reduce the expanded set of 41 potential paradigms to a more manageable set of 12 key paradigms. The combination of selection criteria to get to this set was loosely applied by taking the quantitative prevalence of paradigms in the debate as a basis, but also factoring in other criteria in a qualitative way. This led for instance to the decision to include 'Great Mindshift' into the final set of paradigms by combining it with Transition Theory and taking 'Great Mindshift' as the overall title for the combined set. Despite the prevalence of Great Mindshift of n=1 in the policy documents, this decision was motivated by the fact that Great Mindshift takes its theoretical basis largely from Transition Theory and the title 'Great Mindshift' is more descriptive than the more general term 'Transition Theory'.

In the *analysis of paradigm features*, the interpretation of quantitative data that were generated by the AI extraction was a challenge. The amount of information generated was so large that it tended to lead to blurring distinctions between paradigms. For instance, results of the AI extraction suggested that all 12 selected paradigms involved policies towards norms and values change, contrary to the idea from the exploratory research that Green Growth and Mission Economy would rather not involve such changes. A solution was found here again by a qualitative interpretation of the data, and in particular of the limiting conditions that were formulated per paradigm: Green Growth stated that norms and values change policies only could be applied when 'not hindering economic growth' and Mission Economy stated that such policies had to be 'aligned' with the

missions. Post Growth and other paradigms stated that 'significant shifts in lifestyles' would be required. Overall, this led to the interpretation by the research team that Green Growth and Mission Economy rather not focus on norms and values change policies, and Post Growth and other paradigms do have such a focus.

Contradictory information turned out to be an issue in the *grouping and taxonomy of paradigms*. While the paradigm taxonomy based on the quantitative scientific literature analysis showed all paradigms to tend to 'top-down' governmental interference, the quantitative policy document analysis showed paradigms to tend more towards 'bottom-up' approaches - the latter being more in line with the previous exploratory research. The differences between scientific literature and policy documents are explained by the research team as stemming from differences in how 'top-down' and 'bottom-up' governmental involvement is discussed in the scientific versus in the policy community. For instance, the Green Growth paradigm involves internalisation of externalities into market prices by setting regulations or using market-based instruments, e.g., emission trading systems. The market subsequently determines what decisions on, e.g., technological innovation are taken. In the exploratory research this was interpreted as a leading role for business in taking final decisions for change, e.g., as a 'bottom-up' approach. In literature, however, the regulations set by the government might be seen as the key driver, hence a 'top-down' approach.

Normative decisions again had to be taken in the clustering of paradigms in order to describe four distinctive *Beyond Growth storylines*. Elements of the paradigms 'Post Growth' and 'Degrowth' were combined as one storyline under the heading of 'Post Growth', while in practice there are differences between some of the features of these paradigms. It is therefore important to note that the storylines in this report have to be regarded as *designed* storylines, not as storylines that can be unequivocally reproduced from the information that was analysed in the research process.

Finally, it is important to stress that much care was taken to assure a careful design process of alternative growth paradigms that is as much as possible based on the current international scientific, policy and public Beyond Growth debate. The exploratory research previous to MultiFutures helped to shape search directions by already discovering some of the main paradigms out in the discussion and by already finding some key differences between them. This search was partly repeated and expanded by the research carried out in MultiFutures, leading to a very rich data set that was qualitatively assessed again. The latter assessment revealed that basic directions of the explorative research were overall confirmed, but that definitions on certain features had to be refined (e.g., what is exactly 'top-down' governmental interference? How should policies to bring about 'norms and values change' be interpreted?). The combination of quantitative and qualitative research in this respect showed to be very successful and therefore could bring further refinement of Beyond Growth storylines in the future.

9.2 Opportunities and bottlenecks for alternative growth paradigms in future societies

The analysis presented above has provided an overview of strengths and weaknesses of paradigms as seen in scientific literature and policy documents. While this information is far from sufficient to give a full-fledged analysis of implementation possibilities of the paradigms, it can provide a basis for some reflections on the implementation possibilities of the storylines in future societies.

Green Growth (combined) seems the storyline that is most implemented so far and in some respects might be regarded as a 'baseline' for the other storylines. It has been adopted by the World Bank, OECD and UNEP more than a decade ago, and it can be found in policy documents of national governments throughout Europe and elsewhere. Further implementation of its main policy route, internalisation of external environmental impacts, can build on the European

emission trading system that has already been implemented for many years. Its current implementation does not require fundamental changes in institutions nor fundamentally influencing norms and values of citizens, therefore continuation and expansion of this paradigm towards other planetary boundaries seems relatively straightforward. Yet, this paradigm is also much criticised for its failure so far to meet both international climate goals and (not yet internationally agreed, but monitored) planetary boundaries. Its fundamental assumption that it is possible to decouple economic growth from increasing environmental pressure is furthermore still insufficiently supported by scientific evidence (e.g. Haberl et al., 2020).

Elements of the *Mission Economy (combined)* storyline are also already implemented in practice. For instance, the European Green Deal and some aspects of Dutch innovation policies mention being inspired by the Mission Economy. The Mission Economy itself is inspired by the US Apollo programme in the 1960s, which was successful in putting a man on the moon within one decade. However, the paradigm is rather unclear as to the kind of missions to be formulated and how to realise those in detail. It is also often criticised for the dominant role of government in orchestrating the large-scale societal missions, implying large risks of betting on the wrong horse for, e.g., technological innovation.

The *Post Growth (combined)* storyline is not yet reported to be implemented by any government in its full scale. However, some policies that are advocated under Post Growth, such as the right to repair, are already due to be implemented by the European Union. However, other features of the paradigm are more controversial and also more difficult to implement. This holds in particular for policies to fundamentally change norms and values towards more ecocentric views and behaviours, but also for drastic reductions in working time, a basic income for all, taxing consumption and a rapid phase out of fossil fuels.

The *Great Mindshift (combined)* storyline finally might be furthest from practical implementation so far. It would require a fundamental institutional shift towards decentral authorities and local self-sufficiency as organisational principles, next to a Great Mindshift towards ecocentric norms and values itself. Investigating potential public and political support therefore is likely to be even more essential as a prerequisite for implementation of this storyline than for the others.

However, current implementation is not a criterion for the analysis of the storylines in this project. It is clear that current socio-technical pathways have not yet led to staying within climate nor overall planetary boundaries. Staying on the beaten tracks therefore might be as risky as exploring new grounds. A careful analysis of a broader set of futures, as conducted in MultiFutures, is essential for preparing for societal futures that may be either closer to or further from our current societal design.

10 Conclusions and further work in MultiFutures

10.1 Overall conclusions

The work described in this report resulted in a matrix of paradigms, which is represented in Figure 11 and repeated here (Figure 12).

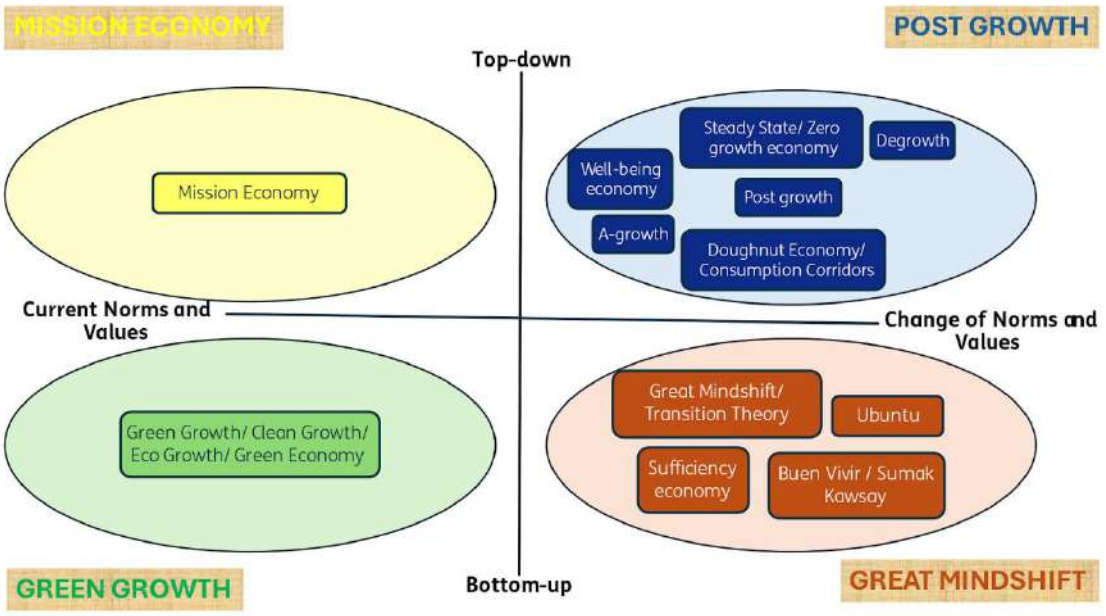


Figure 12: Final proposed taxonomy of alternative growth paradigms

The taxonomy was based on the selection of 12 key paradigms and the careful analysis of 11 main features in which they differ. This led to proposing four distinct storylines for MultiFutures. These describe alternative paradigms that comprise four different societal futures and policy pathways towards sustainability that emerge from the current public and scientific Beyond Growth debate. The proposed storylines are: Green Growth, Mission Economy, Post Growth and Great Mindshift.

The storylines are different normative visions of future societies, with different interpretations of what 'welfare' would mean to these societies, and different routes to achieve the desired outcomes. They are designed by the research team based on qualitative and quantitative literature analysis, taking decisions on the actual contents of the storylines based on the best information available.

The storylines therefore should not be regarded as the final outcomes of the Beyond Growth debate. In practice, some features of the storylines overlap. Hence, the storylines should be seen as representing four different and extreme angles of the debate that emerge from the analysis. These will be used in this project for further modelling analysis which will help to clarify the outer borders of potential impacts of different routes towards, and interpretations of, sustainable societies in the future that are currently in debate.

It is therefore also purposeful that the storylines were given names that are derived from the Beyond Growth debate, rather than neutral names which are more common in modelling analysis.

In this way, the outcomes of the impact analyses made in this project can inform the societal debate, rather than stay within the realm of the modelling community and experts only.

However, here again it should be taken into consideration that the key features of the storylines are derived by combining features from several different paradigms that appear in the Beyond Growth discussion: The 'Post Growth' storyline is the project team's interpretation of 'Post Growth' as it is found in the scientific and public debate, made by also blending features of 'Degrowth', 'Steady State' and other paradigms into the storyline.

10.2 Further work

The development of the four storylines as outlined in this report is only the beginning of the work in MultiFutures. Further work will now follow in the project. A schematic outline of this work as it can be seen now is given in Figure 13.

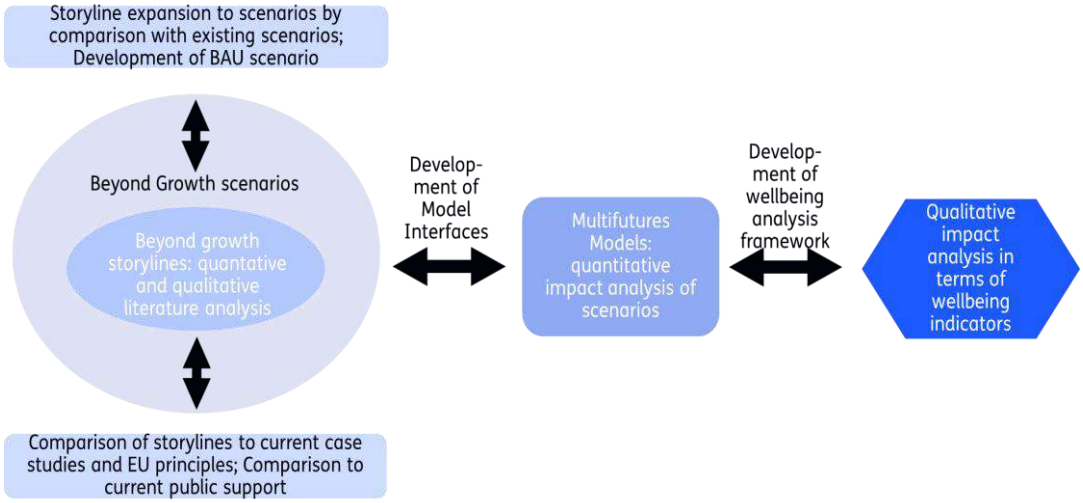


Figure 13: Schematic outline of further work in MultiFutures

During the next steps of the MultiFutures, the qualitative storylines will have to be worked out into quantitative scenarios. As MultiFutures includes several types of models, whose inputs and outputs differ between each other, we need to define which inputs are the same for all the models, like demographics, exogenous prices, policies, etc., and where the models differ. Points of attention in this respect include:

The Baseline

- Scale (all scenarios to be implemented at least on an EU or European scale?)
- Demographics (all scenarios with the same demographics? Which ones to be used?)
- Geopolitics (what are geopolitical developments outside the EU? To be assumed the same for all scenarios?)
- World market prices outside EU (one standard?)

Differentiation

- Sectoral policies (What are detailed sectoral policies for e.g. energy sector, transport sector, industry, housing and employment? How are these differentiated between the scenarios?
- Planetary boundaries (Do all scenarios have to realise the same planetary boundaries? Or do some realise current climate targets and others further going planetary boundaries? Or is the degree of achievement of these targets an output of the scenarios?

Next steps will have to focus primarily on making key decisions, followed by the development of interfaces that can translate the scenarios into inputs for the various models used in the project. The impact analyses produced by these models will then be interpreted in relation to the wellbeing variables central to the project.

The overall project process will also involve examining which baseline variables can be applied across all scenarios, as well as defining a business-as-usual scenario. Additionally, different case studies will be compared to assess the extent to which the various storylines are already in practice in EU countries and globally. Finally, surveys and workshops will be conducted to explore current public support for the different storylines. This process will be outlined in the upcoming MultiFutures reports.

11 References

This report is based on an extensive search of literature in four databases: Elsevier Scopus (https://www.scopus.com/) for academic literature, Elsevier SciVal (Scopus) (https://www.elsevier.com/products/scival) and EC OECD STIP Compass (https://stip.oecd.org/stip/) for policy documents and GDELT (https://www.gdeltproject.org/data.html) for the public discussion on alternative growth paradigms. An extensive literature list can be sent on request.

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12 Document Information

Version Number	**2.0**
WP Number	1
WP Lead Partner	TNO
Date	November 2024
Task Number (if applicable)	1.1
Document Type	Deliverable D1.1 (Taxonomy)
Distribution	Public
Summary	This report presents an analysis of the alternative growth debate taking place in the scientific, public and policy realm and presents a taxonomy of alternative societal futures in this debate. From the analysis, four main storylines are derived as a basis for further research in MultiFutures. The research consisted of an extensive literature review, questionnaire and AI search as a basis for mapping the alternative growth debate. From this, 4 main storylines emerged: Mission Economy, Post Growth, Green Growth, Great Mindshift. These storylines differ in particular in their views on norms and values change (*not needed* or *necessary*) and governance (*top-down* or *bottom-up*). The storylines will be the basis for further scenario and modelling work in MultiFutures.
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Peer Review(s)	Tiina Koljonen (VTT), Benjamin Kirchler (EI-JKU), Andrea Kollmann (EI-JKU), Franz Schönburg (EI-JKU), Vasileios Rizos (CEPS), Patricia Urban (CEPS), Kristian Finsveen Liven (NTNU)
Revision History	Version 1.0 October 2024

Appendix 1 Trend charts of paradigm frequencies in the Beyond Growth debate

Key words used for making trend charts of the academic and policy discussion are presented in Table A2.1.

PARADIGM	SEARCH
Green Growth	TITLE-ABS-KEY (("Green Growth" AND "economy") OR ("clean growth" AND "economy") OR (("eco growth" OR "ecogrowth" OR {eco-growth}) AND "economy"))
mission economy	TITLE-ABS-KEY ("mission economy")
post growth	TITLE-ABS-KEY (({post-growth} OR "post growth") AND "economy")
a growth	TITLE-ABS-KEY (({a-growth} OR "agrowth") AND "economy")
doughnut economy	TITLE-ABS-KEY (("doughnut economy") OR ("donut economy") OR ("consumption corridors"))
transition theory	TITLE-ABS-KEY (("transition theory" AND "sustainab*" AND "economy") OR ("great mindshift"))
buen vivir sumak kawsay	TITLE-ABS-KEY (("buen vivir") OR ("sumak kawsay"))
ubuntu economy	TITLE-ABS-KEY ("ubuntu" AND "economy")
wellbeing economy	TITLE-ABS-KEY ("wellbeing economy" OR {well-being economy})
steady state economy	TITLE-ABS-KEY (("steady state economy") OR ("zero growth" AND "economy"))
sufficiency economy	TITLE-ABS-KEY ("sufficiency economy")

Table A2.1: Keywords used for the selected paradigms in the data search process. The search examples are from Scopus - academic literature searches. In addition the search was restricted between years 2010-2023

Trend charts of paradigms in the Beyond Growth debate in academic literature

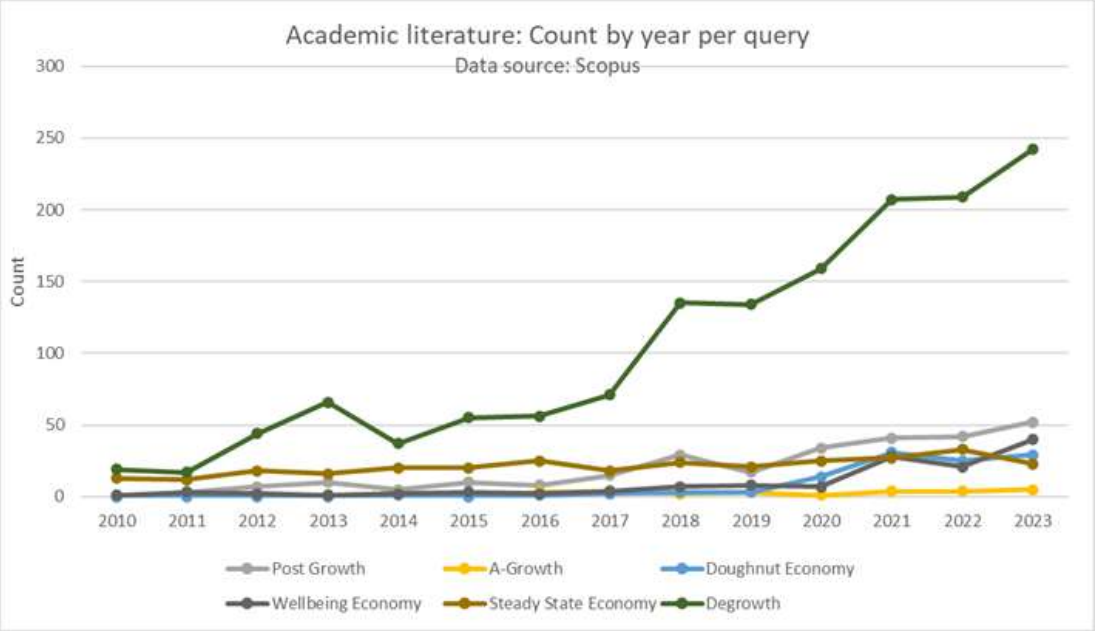


Figure A2.1: Academic literature Count by year by alternative economic paradigms in the "Post Growth" group in the taxonomy. Data source: Scopus

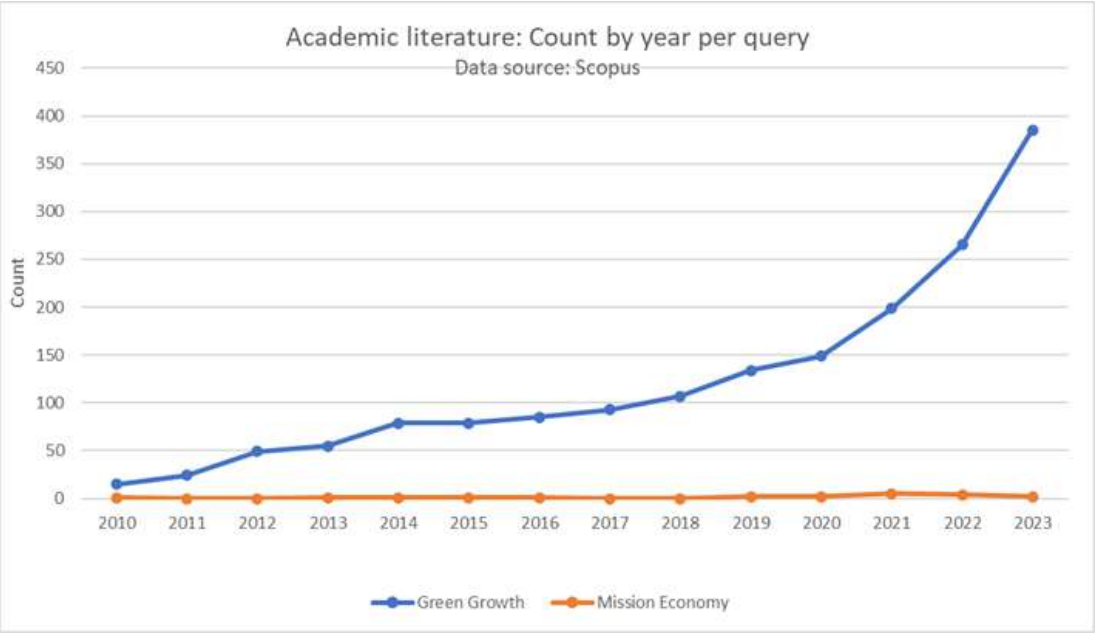


Figure A2.2: Academic literature Count by year by alternative economic paradigms in the "Green Growth and Mission Economy" group in the taxonomy . Data source: Scopus

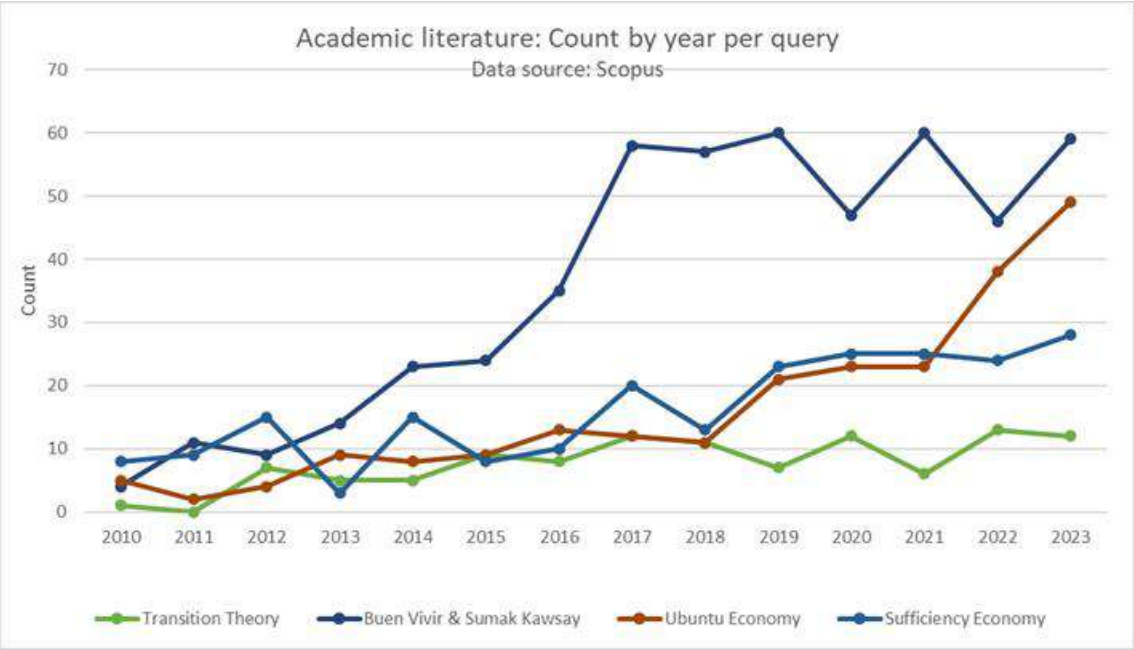


Figure A2.3: Academic literature Count by year by alternative economic paradigms in the "Great Mindshift" group in the taxonomy. Data source: Scopus

Trend charts of paradigms in the Beyond Growth debate in policy documents

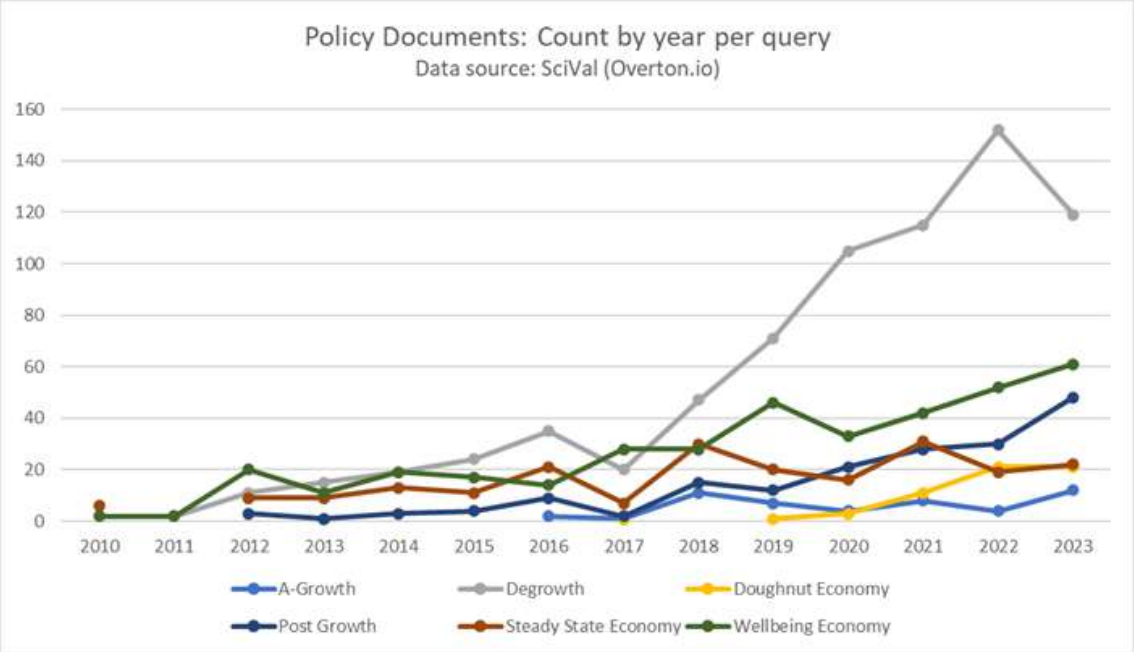


Figure A2.4 - Policy documents Count by year by alternative economic paradigms in the "Post Growth" group in the taxonomy. Data source: SciVal

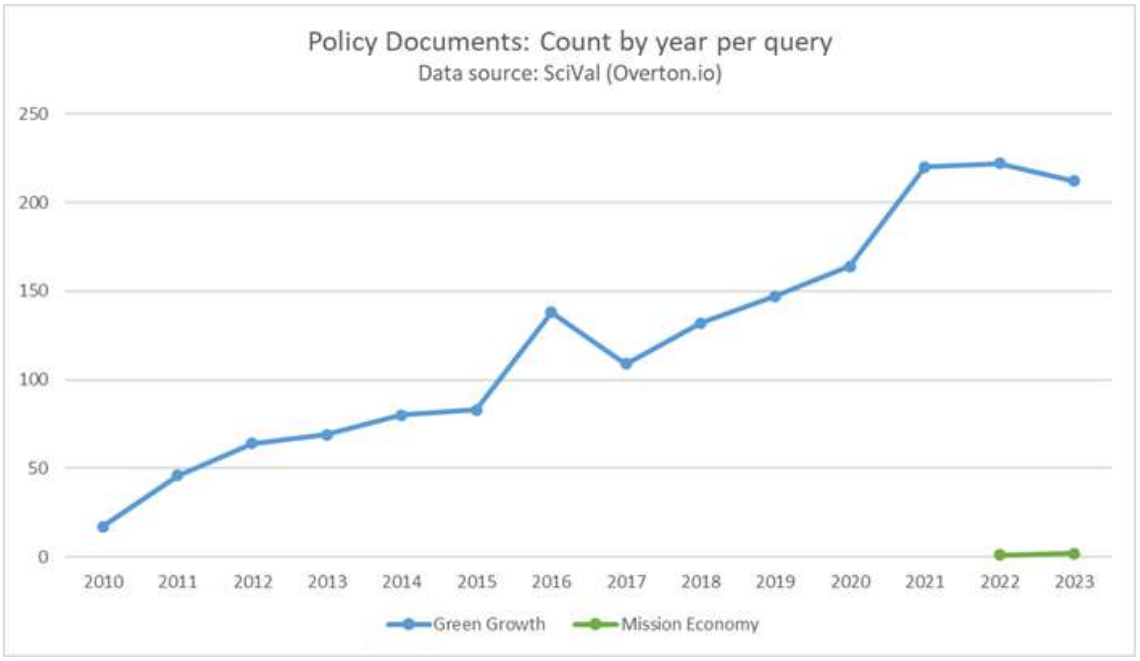


Figure A2.5: Policy documents Count by year by alternative economic paradigms in the "Green Growth and Mission Economy" group in the taxonomy . Data source: SciVal

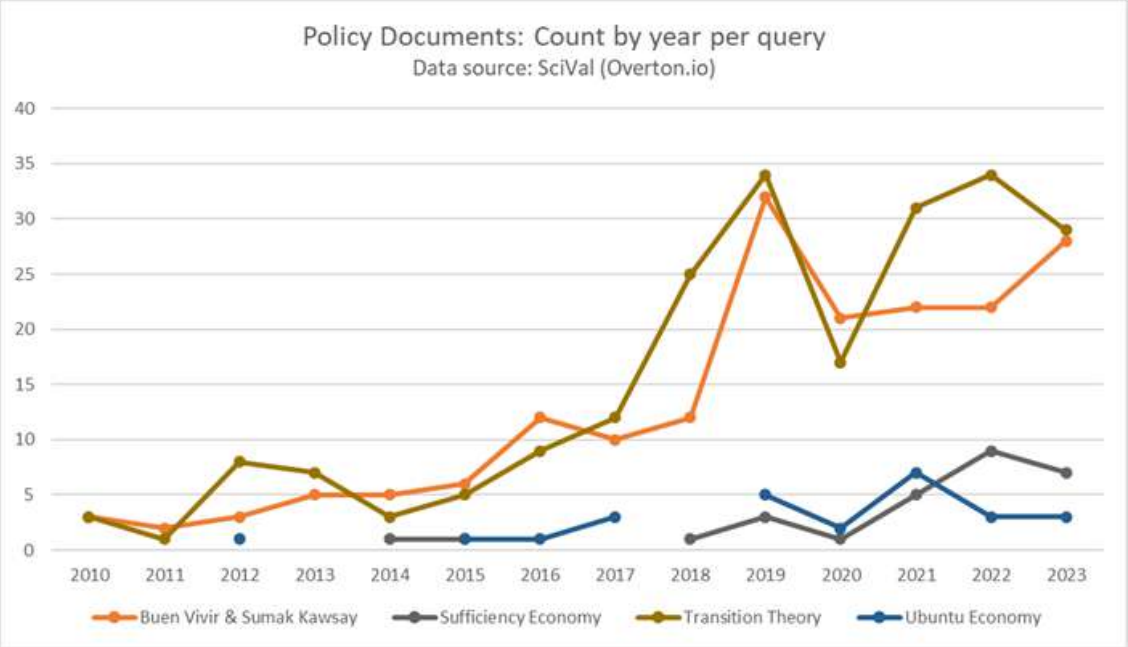


Figure A2.6: Policy documents Count by year by alternative economic paradigms in the "Great Mindshift" group in the taxonomy. Data source: SciVal

Trend charts of paradigms in the Beyond Growth debate in the public discussion

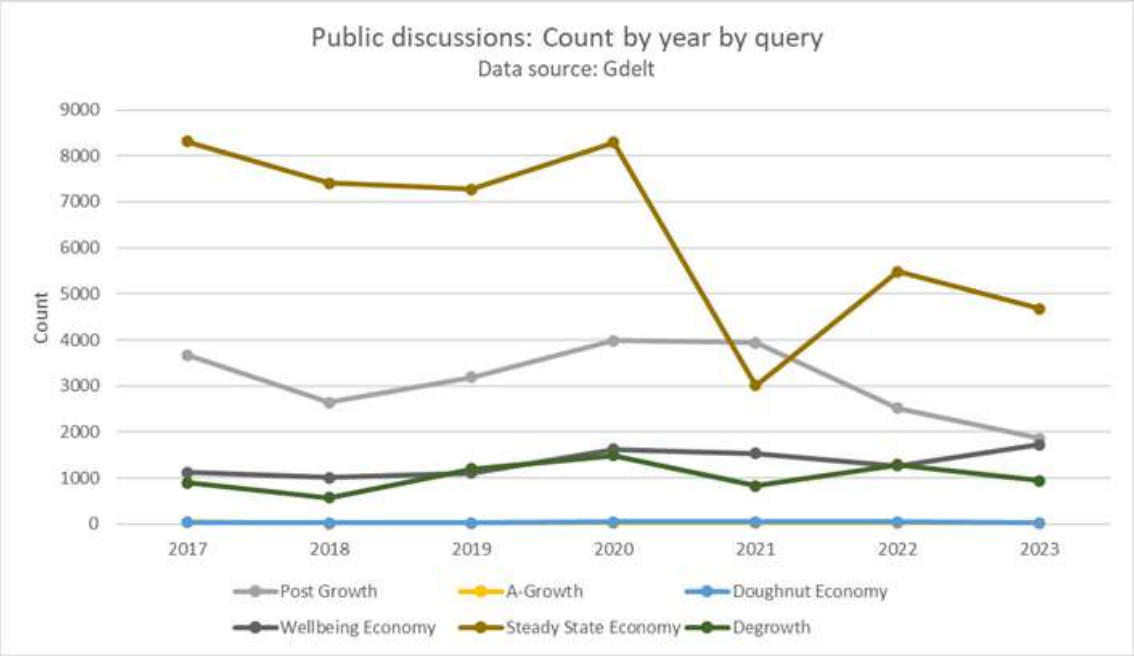


Figure A2.7: Public discussion Count by year by alternative economic paradigms in the "Post Growth" group in the taxonomy. Data source: Gdelt

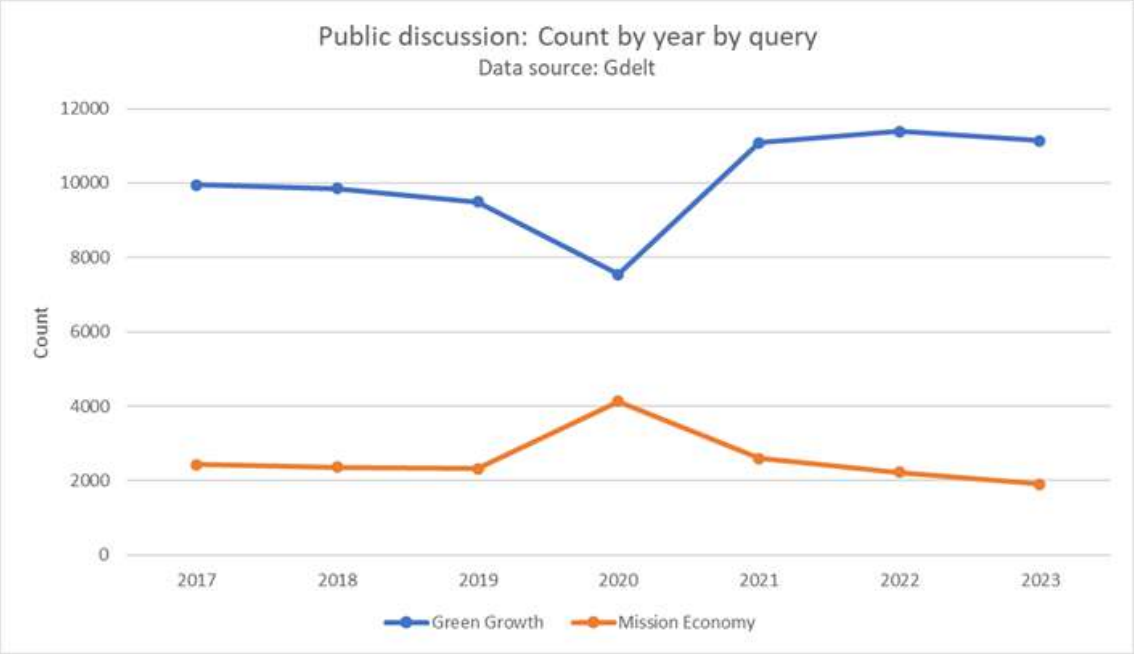


Figure A2.8: Public discussions Count by year by alternative economic paradigms in the "Green Growth and Mission Economy" group in the taxonomy . Data source: Gdelt

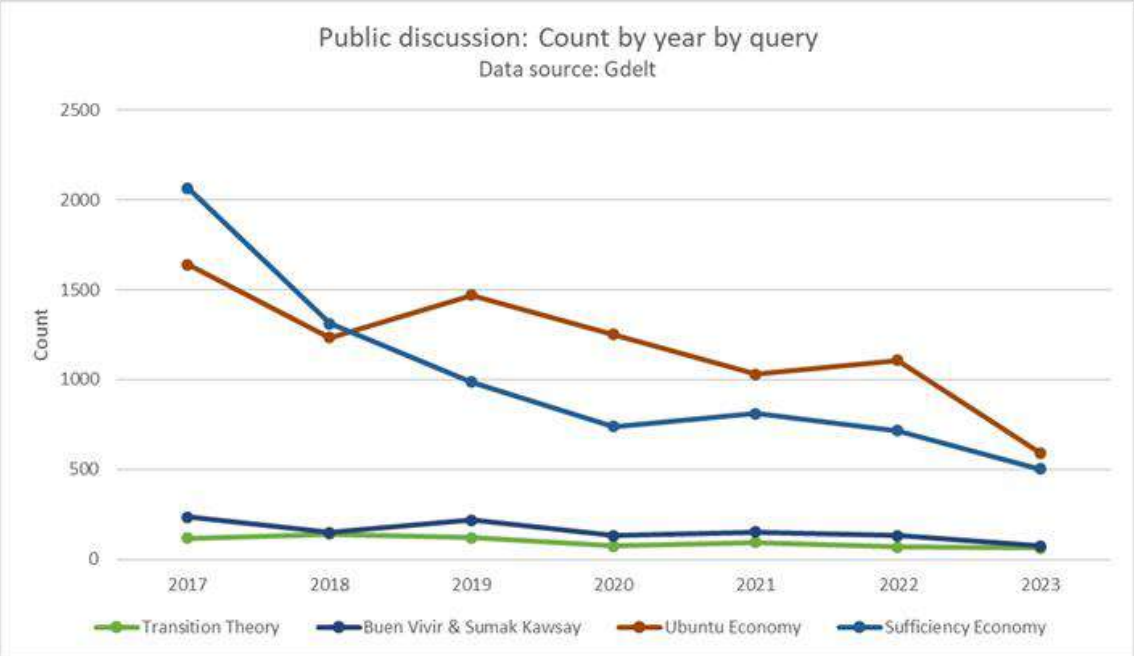
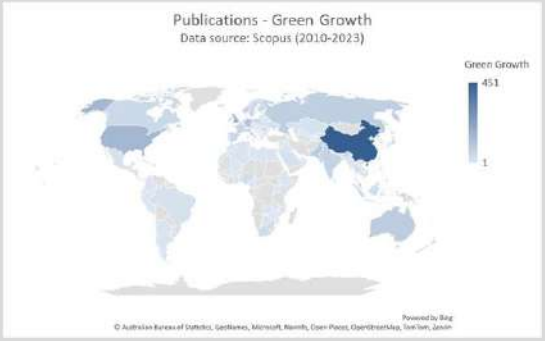


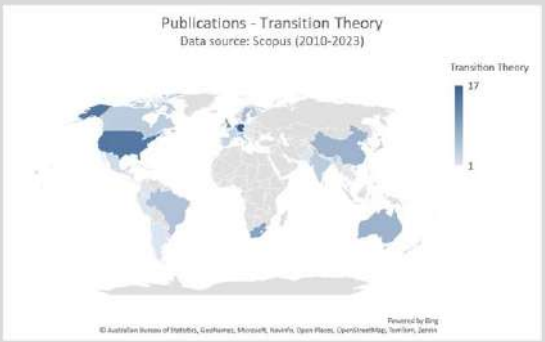
Figure A2.9: Public discussions Count by year by alternative economic paradigms in the "Great Mindshift" group in the taxonomy. Data source: Gdelt

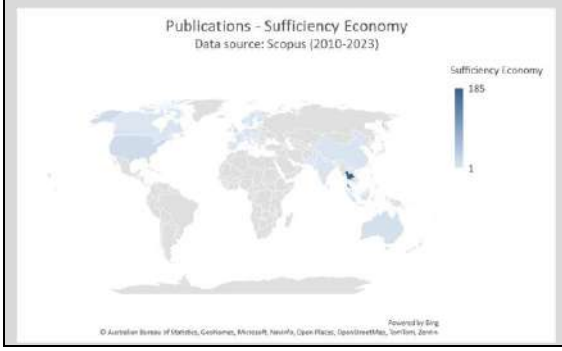
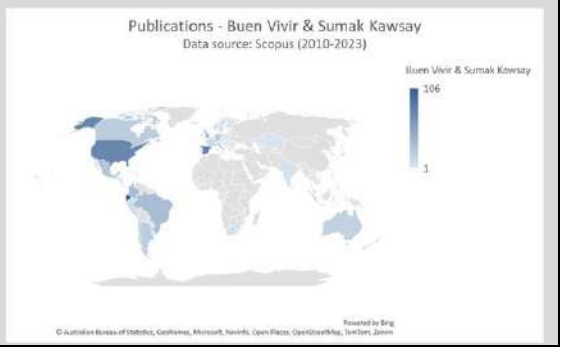
Appendix 2 Geographical distribution of paradigm frequencies in the Beyond Growth debate

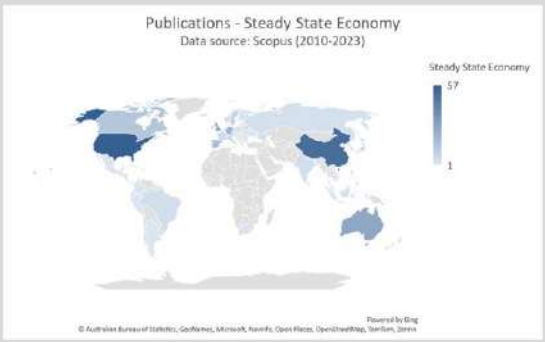
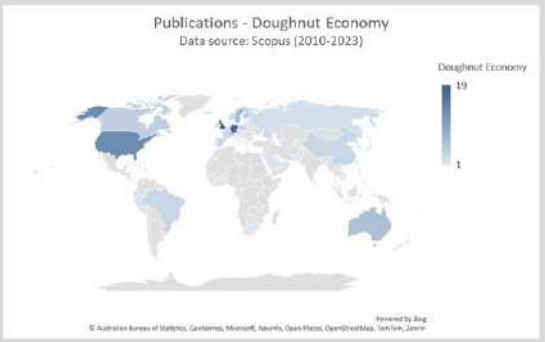
Global distribution of academic literature on alternative growth paradigms

The maps generated from Scopus academic papers are based on the location data derived from the authors' affiliation information.

GREEN GROWTH	MISSION ECONOMY
	

GREAT MINDSHIFT	
TRANSITION THEORY	UBUNTU ECONOMY
	

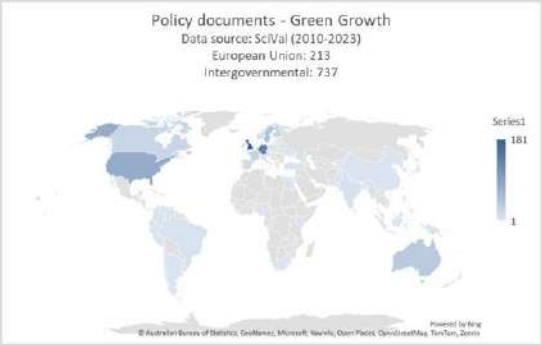
SUFFICIENCY ECONOMY	BUEN VIVIR
	

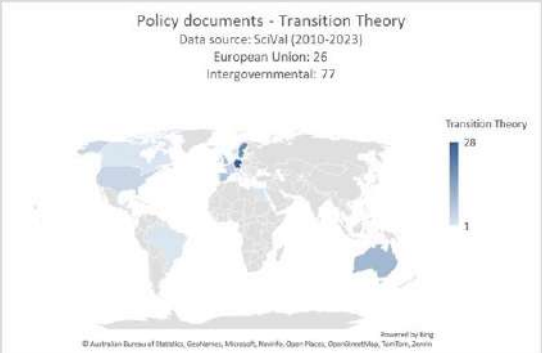
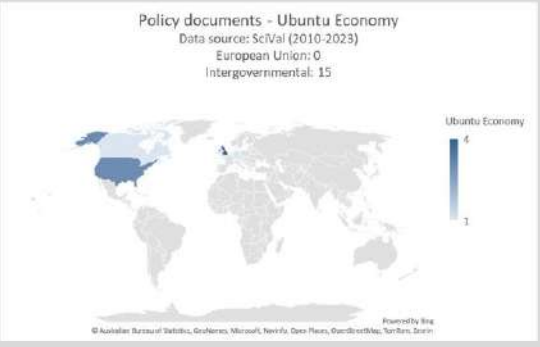
POST GROWTH	
WELLBEING ECONOMY	A-GROWTH
	
STEADY STATE ECONOMY	DOUGHNUT ECONOMY
	

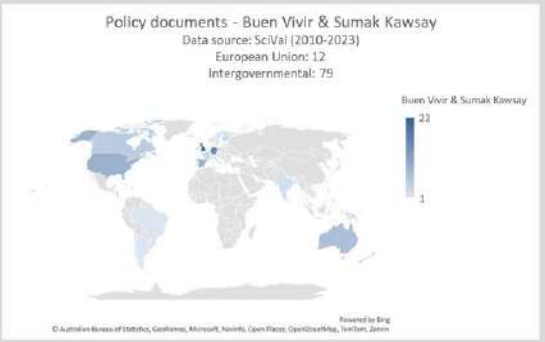
DEGROWTH	POST GROWTH
	

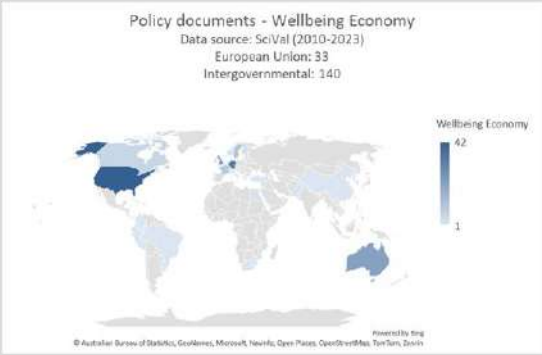
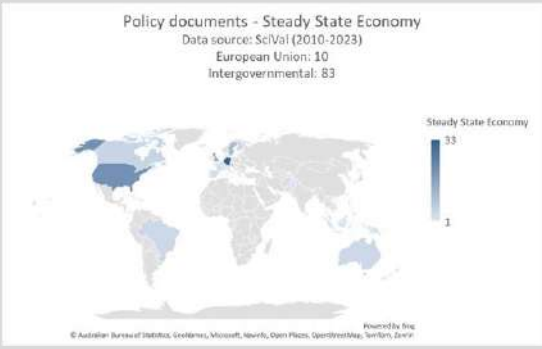
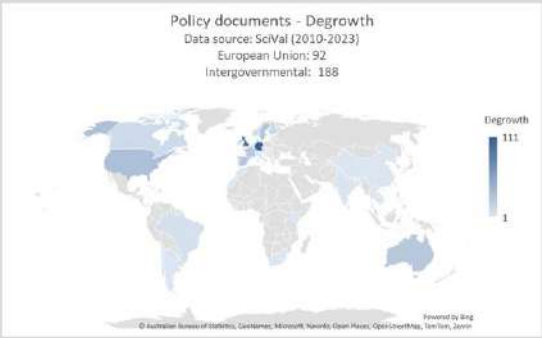
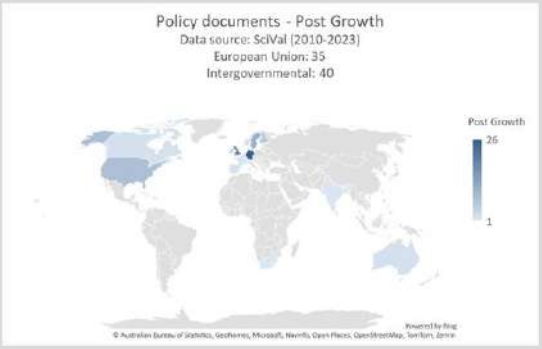
Global distribution of policy documents on alternative growth paradigms (SciVal 2010-2023)

Note that in the figures location of policy documents originated from European Union or Intergovernmental organisations are not on the map, but number of documents are visible on titles.

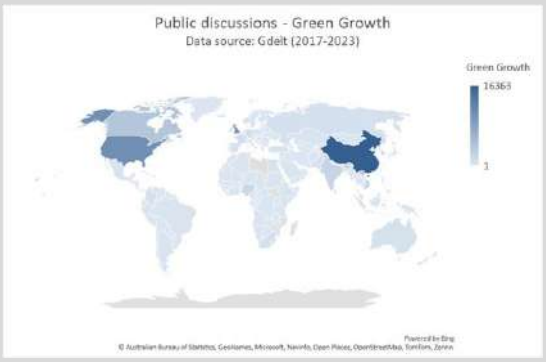
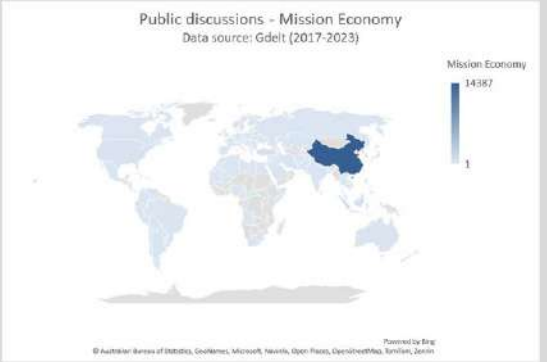
GREEN GROWTH	MISSION ECONOMY
	

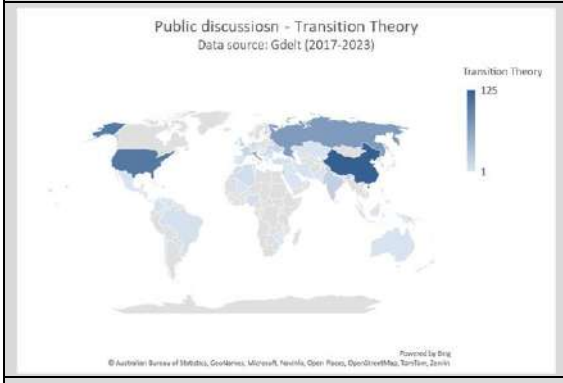
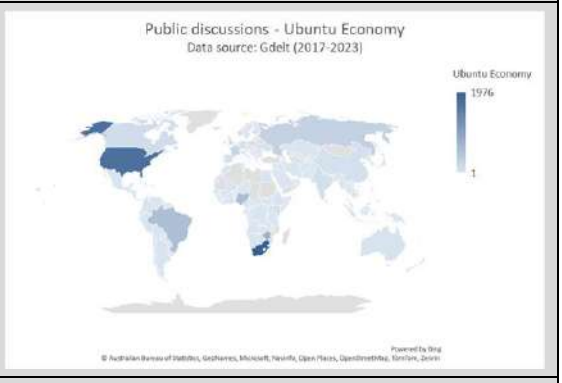
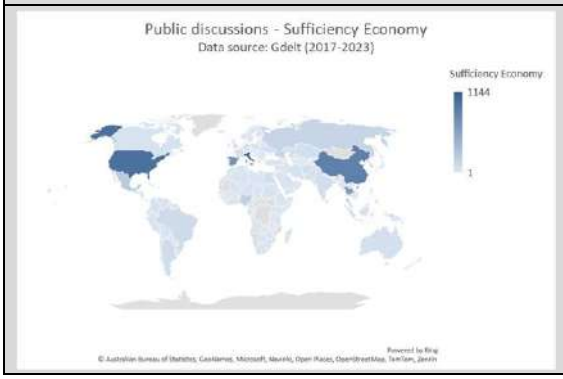
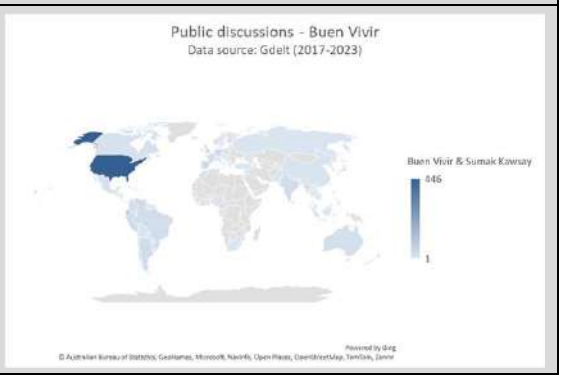
GREAT MINDSHIFT	
TRANSITION THEORY	UBUNTU ECONOMY
	

SUFFICIENCY ECONOMY	BUEN VIVIR & SUMAK KAWSAY
	

POST GROWTH	
WELLBEING ECONOMY	A-GROWTH
	
STEADY STATE ECONOMY	DOUGHNUT ECONOMY
	
DEGROWTH	POST GROWTH
	

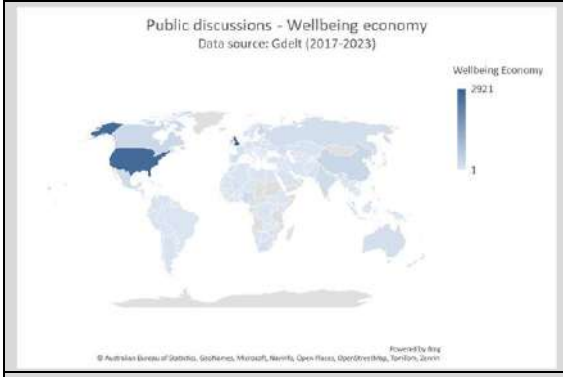
Global distribution of public discussion on alternative growth paradigms (Gdelt 2017-2023)

GREEN GROWTH	MISSION ECONOMY
	

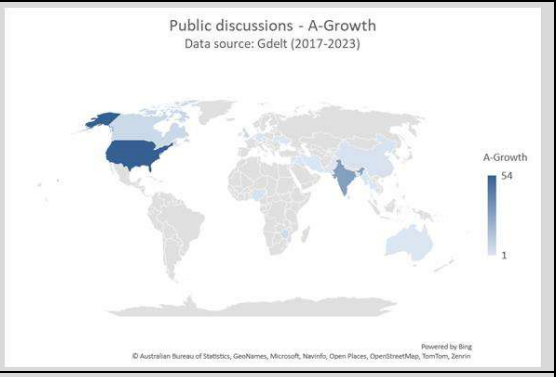
GREAT MINDSHIFT	
TRANSITION THEORY	UBUNTU ECONOMY
	
SUFFICIENCY ECONOMY	BUEN VIVIR
	

POST GROWTH

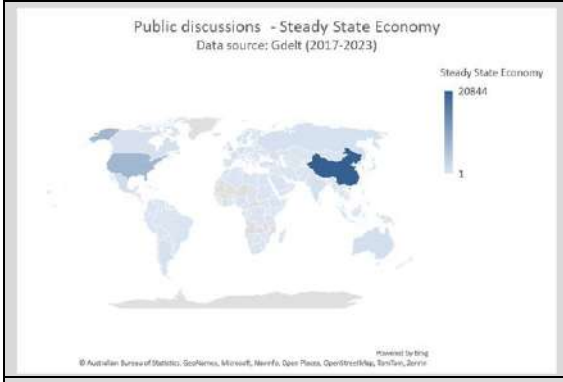
WELLBEING ECONOMY



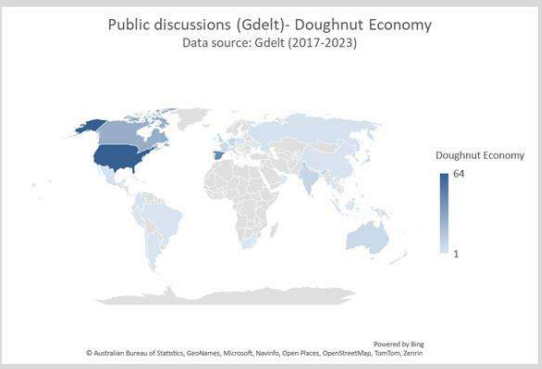
A-GROWTH



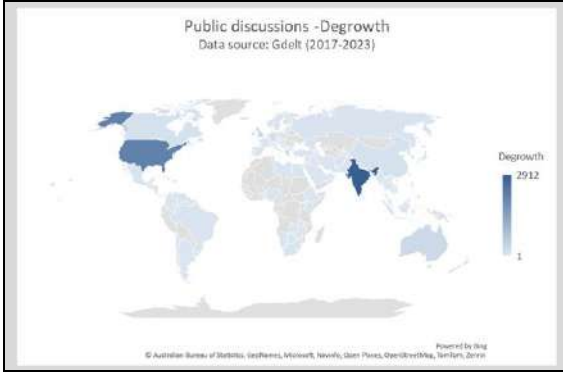
STEADY STATE ECONOMY



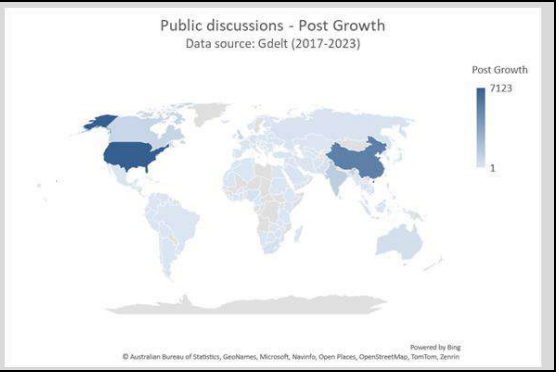
DOUGHNUT ECONOMY



DEGROWTH



POST GROWTH



Appendix 3 Method for AI paradigm feature extraction and clustering for a taxonomy

FEATURE	DOCUMENT LEVEL PROMPT	AGGREGATE LEVEL PROMPT
Summary	Using the information provided, your task is to summarize the discussion of "[REPLACE]" as an economic paradigm. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to summarize the discussion of "[REPLACE]" as an economic paradigm and how "[REPLACE]" challenges traditional notions of economic growth and development. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Norms, values, and behavioural change	Using the information provided, your task is to evaluate whether "[REPLACE]" as an economic paradigm requires a change in current societal norms and values, as well as whether it requires a change in individual behaviour (e.g., changes in diet, plane travel, etc.). Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to evaluate whether "[REPLACE]" as an economic paradigm requires a change in current societal norms and values, as well as whether it requires a change in individual behaviour. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Policy instruments and actions (future)	Using the information provided, your task is to determine what kind of policies or initiatives "[REPLACE]" as an economic paradigm propose. These may be government policies or actions by other stakeholders, e.g. citizens, businesses. Avoid using jargon language, be concise and clear, and deliver only information	Using the information provided, your task is to determine what kind of government policies or initiatives, or actions by other stakeholders, that "[REPLACE]" as an economic paradigm proposes. Be concise and clear, and make sure to cite your

FEATURE	DOCUMENT LEVEL PROMPT	AGGREGATE LEVEL PROMPT
	that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Concrete actions (past)	Using the information provided, your task is to determine what concrete actions and initiatives have been done to implement "[REPLACE]" as an economic paradigm. These may be government policies or actions by other stakeholders, e.g. citizens, businesses. Return only actions and initiatives that have been implemented, not actions and initiatives that are merely proposed. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to determine what concrete actions and initiatives have been done to implement "[REPLACE]" as an economic paradigm proposes. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Limitations	Using the information provided, your task is to determine limitations, weaknesses, potential risks, drawbacks, side-effects, bottlenecks and main criticism of "[REPLACE]" as an economic paradigm. Return only limitations, weaknesses, potential risks, drawbacks, side-effects, bottlenecks and main criticism of "[REPLACE]", not those of other paradigms mentioned in the text. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to determine limitations, weaknesses, potential risks, drawbacks, side-effects, bottlenecks and main criticism of "[REPLACE]" as an economic paradigm. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Strengths	Using the information provided, your task is to determine strengths, main potentials, positive aspects, and	Using the information provided, your task is to determine strengths, main potentials,

FEATURE	DOCUMENT LEVEL PROMPT	AGGREGATE LEVEL PROMPT
	advantages of "[REPLACE]" as an economic paradigm. Return only strengths, main potentials, positive aspects, and advantages of "[REPLACE]", not those of other paradigms mentioned in the text. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	positive aspects, and advantages of "[REPLACE]" as an economic paradigm. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Role of GDP	Using the provided information, your task is to determine the role of GDP for "[REPLACE]" as an economic paradigm. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved from the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to determine the role of GDP for "[REPLACE]" as an economic paradigm. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Key scaling actor (top down / top bottom)	Using the information provided, your task is to identify whether the primary driver of change for "[REPLACE]" as an economic paradigm is governmental policies or initiatives from markets, businesses, or citizens. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to identify whether the primary driver of change for "[REPLACE]" as an economic paradigm is governmental policies or initiatives from markets, businesses, or citizens. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Impacts on environment /	Using the information provided, your task is to evaluate what the long-term impacts	Using the information provided, your task is to evaluate what the

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planetary boundaries	on the environment that "[REPLACE]" as an economic paradigm is expected to have. Summarize discussions of the consequences of this paradigm's actions, activities, or developments on planetary boundaries and climate change. Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	long-term impacts on the environment that "[REPLACE]" as an economic paradigm is expected to have. Summarize discussions of the consequences of this paradigm's actions, activities, or developments on planetary boundaries and climate change. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Impacts on society	Using the information provided, your task is to determine the long-term goals, the final impacts, or the desired changes in society that "[REPLACE]" as an economic paradigm aims at and how "[REPLACE]" will reach this intended societal impact (e.g., through proposed policies). Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	Using the information provided, your task is to determine the long-term goals, the final impacts, or the desired changes in society that "[REPLACE]" as an economic paradigm aims at and how "[REPLACE]" will reach this intended societal impact (e.g., through proposed policies). Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Indicators	Using the information provided, your task is to determine the indicators associated with "[REPLACE]" as an economic paradigm. These may include indicators used in modelling "[REPLACE]" or indicators suggested for measuring and monitoring "[REPLACE]". Avoid using jargon language, be concise and clear, and deliver only information that is retrieved in the text. If available, capture	Using the information provided, your task is to determine the indicators associated with "[REPLACE]". These may include indicators used in modelling "[REPLACE]" or indicators suggested for measuring and monitoring "[REPLACE]". Be concise and clear, and make sure to cite your

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	concise details, including any examples or cases. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.	sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Definition		Using the information provided, your task is to provide a definition of "[REPLACE]". Be concise and clear. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Goals		Using the information provided, your task is to determine the explicit goals of "[REPLACE]". Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.
Role of technological innovation		Using the information provided, your task is to determine the role of technological innovation in "[REPLACE]". This may include whether and how technological innovation is discussed as a part of achieving "[REPLACE]" and how it's role is perceived in a "[REPLACE]" world. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No

FEATURE	DOCUMENT LEVEL PROMPT	AGGREGATE LEVEL PROMPT
		information" and do not elaborate.
Redistribution of wealth		Using the information provided, your task is to determine whether and how redistribution of wealth is discussed in "[REPLACE]". This may include whether and how redistribution of wealth is discussed as a part of achieving "[REPLACE]" and how it is perceived in a "[REPLACE]" world. Be concise and clear, and make sure to cite your sources inline by referencing the EIDs associated with the text that the information comes from. Do not exceed 300 words in your response. If there is no discussion or mention of the topic, respond "No information" and do not elaborate.

Table A4.1 – Feature Extraction Prompts

Clustering Prompts

FEATURE	PROMPT
Norms, values, and behavioural change	Using the information given, cluster and rank the economic paradigms relative to one another on whether and to what degree they require a change in current norms and values. Then provide a numerical index point for each economic paradigm relative to the most neutral paradigm.
Key scaling actor (top down / top bottom)	Using the information given, cluster and rank the economic paradigms relative to one another on the degree to which the primary driver of change is top down (government policies) or bottom up (initiatives from markets, businesses, or citizens). Then provide a numerical index point for each economic paradigm relative to the paradigm that is most neutral.

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