KOCHI UNIVERSITY OF TECHNOLOGY

Social Design Engineering Series *SDES-2025-13*

Future generations and intergenerational sustainability towards SDGs: A comprehensive review for behavioral and institutional decision making

Natasya Ghinna
School of Economics and Management, Kochi University of Technology
Environmental Sustainability Research Group, Faculty of Engineering, Universitas Diponegoro

Koji Kotani
School of Economics and Management, Kochi University of Technology
Urban Institute, Kyushu University
College of Business, Rikkyo University

December 25, 2025

School of Economics and Management
Research Institute for Future Design
Kochi University of Technology

Future generations and intergenerational sustainability towards SDGs: A comprehensive review for behavioral and institutional decision making

Natasya Ghinna[*,†] Koji Kotani[*,‡,§,¶]

December 25, 2025

Abstract

For Sustainable Development Goals (SDGs), considerations to future generations and intergenerational sustainability are required and must be integrated into interventions and policies for human behaviors and decision making. Yet, such interventions and policies remain underdeveloped despite their potential contribution. We conduct bibliometric and content analyses of 119 peer-reviewed publications over 20 years with a focus on future generations and intergenerational sustainability. To this end, a conceptual framework is developed, combining cognitive, noncognitive and socioeconomic factors to be parts of interventions and policies for behaviors and decisions towards SDGs. With the framework, this review maps the evolution of the literature and spots a set of open questions as well as future directions of research. We find that the literature has expanded steadily and reveal two main insights. First, the related studies mainly examine interventions and policies on short-run behaviors and decisions, such as generative, cooperative and sustainable behaviors, overlooking inquisitive, creative and productive ones. Second, there are few studies that analyze long-run changes in behaviors and decisions, implying the necessity of further studies on how interventions and policies shall be able to influence people's deliberative cognitive processes for the long-lasting impact. Overall, we identify clear and practical pathways towards accelerating progress for SDGs through linking actionable interventions and policies to behavioral changes and decision making, such as family-level education and community initiatives.

Keywords: Future generations; Intergenerational sustainability; Behaviors; Decision making; Interventions; Cognitive factors

[*]School of Economics and Management, Kochi University of Technology
[†]Environmental Sustainability Research Group, Faculty of Engineering, Universitas Diponegoro
[‡]Urban Institute, Kyusyu University
[§]College of Business, Rikkyo University
[¶]Corresponding author, E-mail: kojikotani757@gmail.com

Contents

Nomenclature

ACPs Automatic Cognitive Processes

DCPs Deliberative Cognitive Processes

FAB Future Ahead and Back

FD Future Design

FG Future Generations

IA Intergenerational Accountability

IFG Imaginary Future Generations

IGG Intergenerational Goods Game

IS Intergenerational Sustainability

ISD Intergenerational Sustainability Dilemma

ISDG Intergenerational Sustainability Dilemma Game

MVDA Majority Voting with Deliberative Accountability

SDGs Sustainable Development Goals

1 Introduction

Climate change, biodiversity loss and resource scarcity are among the most serious global challenges. They threaten long-term human well-being and the stability of economic and ecological systems (Hu et al., 2018, Diprose et al., 2019). Greenhouse gas emissions remain highly concentrated, with a few major emitters responsible for most environmental impacts (Syropoulos et al., 2023). Rapid economic growth, excessive resource use and unsustainable policies have intensified environmental degradation, health risks, inequality and food and water insecurity (Bithas, 2020, Chang et al., 2021). Biodiversity loss further compounds these problems, undermining ecosystem functions and intergenerational well-being (Teodoro et al., 2023, Wang et al., 2024). The sustainable development goals (SDGs) provide a global framework for transforming production and consumption toward sustainability (Oliveira, 2018, Spijkers, 2018, Pandit et al., 2021). However, progress remains slow. Many institutions still prioritize short-term gains, externalizing costs to future generations (FG) and violating intergenerational equity (Hauser et al., 2014, Fornwagner and Hauser, 2022, Balmford et al., 2024). Addressing these challenges requires both immediate action and long-term strategies that ensure well-being for current and FG.

Research on FG, intergenerational sustainability (IS) and the SDGs has expanded but remains fragmented. Achieving the SDGs depends on generativity, defined as concern for and commitment to the well-being of current and FG (Erikson, 1963, McAdams and Aubin, 1992, Timilsina et al., 2019). High generativity promotes education, social support, mentoring and sustainable practices through legacy building and prosocial engagement (Keyes and Ryff, 1998, Fischer et al., 2004, Urien and Kilbourne, 2011), while low generativity leads to short-term, self-centered behavior that undermines IS (Doerwald et al., 2021). Recent research demonstrates that generativity correlates with happiness and social preferences in developing countries (Shahen et al., 2019), varies between rural and urban societies (Timilsina et al., 2019), is enhanced through inquisitiveness and autonomy (Hirose and Kotani, 2022, Hirose et al., 2023), strengthens children's wellbeing through intergenerational exchanges (Hirose, 2024) and is constructed by older adults through life course narratives emphasizing legacy and continuity (Downey et al., 2016, Grüner and Konzett, 2024).

Although young generations are expected to lead SDGs progress, their roles and characteristics remain underexplored (Yamane and Kaneko, 2021).

Intergenerational sustainability dilemmas (ISDs) occur because the present generation gains the benefits of its actions, while FG who bear the consequences cannot respond, creating asymmetry and temporal distance between them (Kamijo et al., 2017, Shahrier et al., 2017, Timilsina et al., 2021). Experimental studies show that perspective-taking interventions, such as the future ahead and back (FAB) mechanism and future design (FD), enhance sustainable decisions, extend time horizons and evoke empathy for FG (Saijo, 2020, Kamijo et al., 2017, Timilsina et al., 2023, Mostafizur et al., 2025). FD experiments demonstrate that adopting the role of FG shifts preferences toward sustainability and induces persistent behavioral changes (Kamijo et al., 2017, Saijo, 2020). Institutional arrangements including deliberative forums, intergenerational councils,long-term binding commitments and accountability systems strengthen prosocial norms and long-term altruism (Timilsina et al., 2021, 2023, Halali and Perez, 2025). However, the SDGs framework lacks explicit reference to intergenerational equity despite its centrality to sustainable development, revealing gaps between present and FG (Spijkers, 2018). Integrating concern for FG into the SDGs framework is essential to ensure that today's progress builds sustainable well-being across generations. Yet, no existing study integrates FG concern, IS principles and the SDGs into a coherent framework linking actionable interventions and policies to behavioral changes and decision making.

Several studies have examined how interventions and policies can induce behavioral changes and decision making toward sustainability through automatic cognitive processes(ACPs), deliberative cognitive processes (DCPs) and policy or institutional approaches. Interventions targeting automatic cognitive processes, such as nudges, labels and visual prompts, influence behavior through choice architecture without removing options. These approaches often show immediate but short-lived effects (Thaler and Sunstein, 2008, Loewenstein and Chater, 2017, Abrahamse, 2020). DPCs engage reasoning, anticipation and perspective-taking, leading to longer-term behavioral changes (Bamberg and Möser, 2007, Evans and Stanovich, 2013, Timilsina et al., 2020). Experimental

evidence, including FD and FAB, shows that adopting the role of future generations promotes sustainable preferences and prosocial behavior (Kamijo et al., 2017, Saijo, 2020, Timilsina et al., 2023). Policy and institutional approaches work mainly through external rules, incentives and governance systems that shape collective behaviors (North, 1990, Ostrom, 2009, Timilsina et al., 2019). DCPs-based approaches differ from nudge approaches by aiming to internalize motivation and reshape preferences through deliberation, and they differ from policy approaches by working through internal reflection rather than external constraints. Overall, the literature indicates that interventions in ACPs and DCPs can influence sustainability-related behaviors in the short term, but their long-term effectiveness and connections to the SDGs remain unclear (Allcott and Rogers, 2014, Abrahamse, 2020, Amiri et al., 2024).

Existing reviews on sustainability, the SDGs and behavioral changes have advanced understanding in separate domains but remain fragmented across the FG–IS–SDGs landscape. Bibliometric analyses have mapped publication patterns, disciplinary distributions and citation networks in sustainability and SDG research (Sweileh, 2020, Yamaguchi et al., 2023, Mishra et al., 2024), while systematic and narrative reviews have examined SDGs progress, implementation barriers and policy instruments (Bengtsson et al., 2018). Other studies discuss intergenerational equity and the SDGs (Oliveira, 2018, Spijkers, 2018), social and intergenerational equity in well-being (Summers and Smith, 2014), frameworks for obligations to future generations (Tonn, 2018), intergenerational sustainability narratives (Moldavanova, 2016) and sustainability and social welfare (Fleurbaey, 2015). Recent reviews analyze intergenerational activities and older adults' well-being (Whear et al., 2023) and social sustainability in aging societies (Komp-Leukkunen and Sarasma, 2024). However, none systematically connect concern for FG, IS principle and SDG achievement through behavioral pathways and decision mechanisms. Critically, no existing review combines bibliometric mapping with qualitative content analysis to examine how interventions and policies operate through cognitive (automatic and deliberative), noncognitive, and socioeconomic or institutional factors within the FG–IS–SDG nexus. Bibliometric methods provide a broad view of the field's structure and evolution but offer limited depth on conceptual and interventions analyses,

whereas narrative reviews provide detailed interpretation but limited coverage. Integrating these approaches enables a coherent framework for interventions and policies, clarifying what is known and what remains insufficiently understood about how interventions and policies induce long-run behavioral changes and link to the SDGs.

Five critical gaps limit current understanding and application. First, the literature remains fragmented across economics, psychology and sustainability science, with diverse frameworks that hinder theoretical and practical integration (Fleurbaey, 2015, Moldavanova, 2016, Tonn, 2018). Second, most interventions remain short-term and context-specific, providing limited evidence of durable behavioral changes or applicability in real-world settings (Shahrier et al., 2017, Timilsina et al., 2020, Pandit et al., 2021). Third, few studies examine whether intervention effects persist over time and the underlying mechanisms, such as deliberative cognition and value-based processes, remain unclear (Nakagawa and Saijo, 2020a, Shahen et al., 2020, 2021). Fourth, institutional and behavioral factors are often analyzed separately despite their complementarity, leaving limited insight into their interaction in supporting sustainability outcomes (Koirala et al., 2021, Bogacki and Letmathe, 2021, Rose, 2024b,a). Fifth, although some studies explicitly link intergenerational justice with the achievement of SDGs (Spijkers, 2018, Oliveira, 2018, 2023), most FG-IS studies address sustainability in general terms without mapping specific behavioral mechanisms to individual SDG targets. Recent applications targeting specific SDGs like sustainable food consumption remain exceptions rather than the norm (Mostafizur et al., 2025). This leave gaps in understanding which behaviors most effectively advance particular goals. Consequently, a systematic bibliometric and content analysis is required to identify research trends, thematic clusters and conceptual gaps that can advance intergenerational sustainability toward the SDGs.

This study addresses existing gaps through a combined bibliometric and content analysis of research on future generations (FG) and intergenerational sustainability (IS) within the framework of the Sustainable Development Goals (SDGs). The analysis examines publication trends, geographic distribution, author networks, journal outlets, SDG linkages and conceptual orientations, focusing on behavioral (generative, inquisitive, cooperative, sustainable, creative, productive), cog-

nitive (automatic and deliberative) and institutional dimensions. Two research questions guide this work: RQ1 identifies the main trends, themes and gaps in FG–IS studies related to the SDGs, while RQ2 explores their practical applications and implications for advancing sustainability. Overall, this study provides the first integrated synthesis of FG–IS–SDGs research and develops a conceptual framework that combines cognitive, noncognitive and socioeconomic factors to be parts of interventions and policies for behaviors and decisions towards SDGs.

2 Materials and Methods

This comprehensive review integrates bibliometric analysis and qualitative content analysis to systematically map and interpret the scholarly landscape on future generations (FG) and intergenerational sustainability (IS) towards sustainable development goals (SDGs). The combined approach provides both a quantitative understanding of the field's intellectual and conceptual structure and a qualitative synthesis that explores interventions and policies for behaviors and decisions towards SDGs. The workflow follows PRISMA 2020 for transparent identification, screening, and inclusion of studies (Page et al., 2021). Data collection was performed exclusively through the Scopus database, chosen for its extensive coverage of peer-reviewed literature in environmental and social sciences. The search query was defined as TITLE-ABS-KEY ((future AND generation) OR generativity AND intergenerational AND sustainable OR sustainability OR SDG). It was restricted to English-language publications from 2014 to August 2025 and yielded 488 documents.After automatic filtering by publication type (articles, reviews and conference papers) and source type (journals and proceedings), the dataset was reduced to 261 documents. Further manual screening was conducted to ensure thematic alignment with FG, IS and the SDG framework.

Studies were excluded if they addressed unrelated topics or lacked explicit connections to FG or IS. Specifically, excluded papers focused primarily on: Environment and Natural Resources (49), Governance, Policy and Economy (31), Social, Cultural and Ethical Aspects (28), Education and Research (10), Infrastructure, Urban Development and Transport (8), Miscellaneous and Language

Exclusions (8) and No Access (4). After this process, a final corpus of 119 relevant papers was retained for detailed bibliometric and content analysis. Bibliometric analysis was conducted using the R and Python to identify the structural and thematic patterns of the field. Co-word analysis, cluster mapping and thematic evolution diagrams were generated to visualize conceptual linkages among keywords, authors and country. Complementary visualizations, including a Sankey diagram and SDG–year heatmap, illustrated the dynamic evolution of topics and the cross-domain integration of behavioral, environmental and social perspectives in intergenerational research. A qualitative content analysis was then applied to the full texts of the 119 selected papers to extract key conceptual insights. Information from each study was systematically organized in a structured Excel sheet to facilitate interpretation, identify recurring themes and support the development of the conceptual framework. Each record captured four analytical aspects: behavioral focus, SDG linkage, methodological features and main findings.

3 Result and Discussion

3.1 Bibliometrics and Thematic Analysis

3.1.1 Research Output, Impact and Global Network

The bibliometric analysis of 119 documents published between 2014 and August 2025 demonstrates a steady upward trend in research on Future Generations and Intergenerational Sustainability towards the SDGs, with an annual growth rate of (2.31 %) (figure 1). The number of publications increased from 7 in 2014 to a peak of 20 in 2024, reflecting a growing global interest in long-term sustainability and future-oriented studies. Geographically, the research landscape based on all author affiliations reveals strong participation from developed regions, particularly Japan (158 affiliations), followed by the United States (29), China (14), Germany (12), Italy (8) and Australia (9) (figure 2). This pattern indicates that research on intergenerational sustainability is primarily driven by developed countries, while contributions from developing regions such as

Africa and South America remain limited.

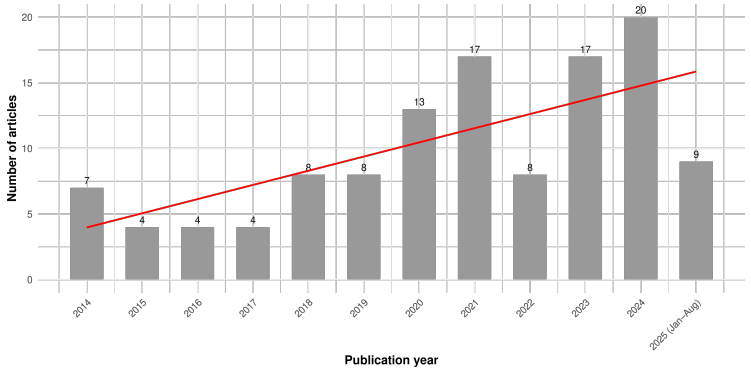

Figure 1: Yearly Publications

Figure 2: World Publications Map (All Affiliations)

The analysis of the most productive authors highlights Japan's leading contribution to this field (Table 1). Saijo T. leads with 23 publications, followed by Kotani K. (18), Nakagawa Y. (10), Kamijo Y. (9) and Komatsu M. (7). In terms of publication sources, Sustainability (Switzerland) leads with 20 articles, while Futures (8), Sustainability Science (6), Ecological Economics (5) and Environmental Economics and Policy Studies (4) also play important roles, reflecting the field's growing connection between sustainability, economics and future studies. Citation performance highlights the interdisciplinary and behavioral-economic reach of the field. The most

cited manuscripts include Hauser O. P. (2014, Nature, 264 citations), Delmas M. A. (2014, Family Business Review, 97 citations) and Kamijo Y. (2017, Sustainability Science, 80 citations). These studies collectively demonstrate how behavioral, psychological and economic mechanisms shape intergenerational decision-making. Hauser et al. (2014) showed that democratic voting can sustain cooperation with future generations by restraining free riders and reassuring conditional cooperators. Delmas and Gergaud (2014) found that family succession intentions strengthen sustainable business practices through transgenerational ties. Kamijo et al. (2017) revealed that involving representatives of imaginary future generations increases pro-sustainability decisions in experimental settings. Together, these works highlight the role of social preferences, institutional design and intergenerational identity in promoting long-term cooperation and sustainability. At the country level, Japan rank first with 537 citations, followed by the United States (425) and the United Kingdom (110). This pattern suggests that citation influence is concentrated in countries with well-established research communities and institutional capacity in experimental and behavioral economics within sustainability studies.

Table 1: Top 10 Authors, Sources, Manuscripts per Citations and Citations per Country

Rank	Authors (articles)	Sources (articles)	Manuscripts (citations)	Country (citations)
1	Saijo, T (23)	Sustainability (Switzerland) (20)	Hauser, O.P., 2014, *Nature* (264)	Japan (537)
2	Kotani, K (18)	Futures (8)	Delmas, M.A., 2014, *Fam Bus Rev* (97)	USA (425)
3	Nakagawa, Y (10)	Sustainability Science (6)	Kamijo, Y., 2017, *Sustainability Sci* (80)	United Kingdom (110)
4	Timilsina, R.R. (7)	Ecological Economics (4)	Conway, S.F., 2016, *J Rural Stud* (67)	Norway (77)
5	Hauser, O.P. (4)	Environmental and Resource Economics (4)	Hara, K., 2019, *Sustainability Sci* (66)	Germany (72)
6	Baumgartner, T. (3)	Frontiers in Psychology (4)	Chiswell, H.M., 2018, *Sociol Ruralis* (63)	Ireland (67)
7	Hara, K. (3)	Politics and Governance (3)	Summers, J.K., 2014, *Ambio* (52)	Netherlands (57)
8	Knoch, D. (3)	Scientific Reports (3)	Spijkers, O., 2018, *Sustainability* (51)	Austria (48)
9	Hirose, J. (3)	Geoforum (2)	Shubert, S., 2017, *Sustainability Sci* (50)	Poland (43)
10	Hizen, Y. (3)	Gerontologist (2)	Oliveira, R.Y., 2018, *Sustainability* (48)	China (42)

The Sankey diagram of top 20 authors-keywords-countries analyzed using R Bibliometrix is shown in figure 3. The width of each flow reflects the strength of the connection between the elements, allowing readers to visualize how authors and national research networks are linked through common research themes identified by keyword analysis. Japanese researchers, including Saijo T., Kotani K. and Nakagawa Y., show strong associations with Future Design, Future Generations, Intergenerational Sustainability and Deliberation, indicating Japan's leading role in

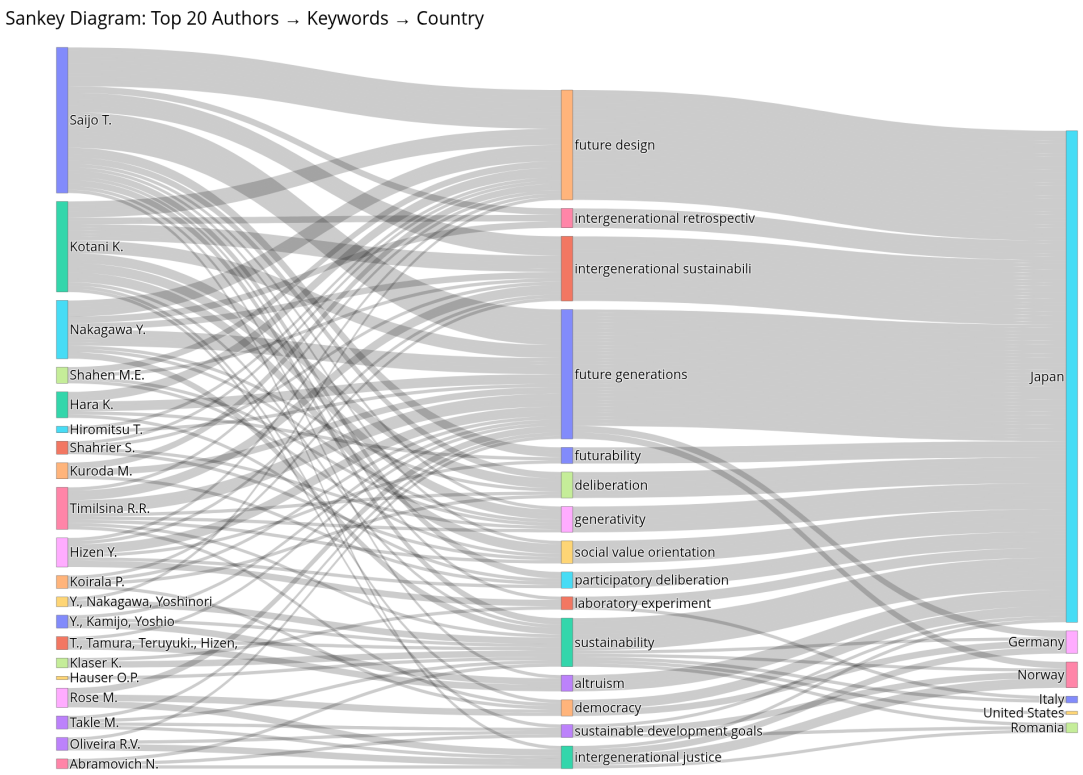

Figure 3: Sankey Diagram

advancing behavioral and experimental approaches to long-term decision-making. Future Design and Future Generations function as the main connecting concepts, bridging related ideas such as Generativity, Futurability and Participatory Deliberation. At the country level, Japan dominates the network with the widest thematic coverage. Germany connects mainly to Intergenerational Justice, Democracy and Future Generations, while Norway links with Intergenerational Justice, SDGs and Future Generations. Italy and the United States relate primarily to Sustainability and Romania connects to Intergenerational Justice, SDGs and Sustainability. Overall, the diagram shows that Japan leads the behavioral and cognitive approaches, while European and American scholars contribute complementary normative and governance perspectives, collectively broadening the scope of intergenerational sustainability studies.

3.1.2 Thematic and SDG Mapping

The thematic and SDG mapping shows how research on Future Generations and Intergenerational Sustainability towards the SDGs is structured and where it is growing. The thematic map was created in R using the Bibliometrix package and a co-word analysis approach. The map helps to understand the current research landscape and to identify future directions for development (Bagdi et al., 2023). It is measured based on centrality and density. Centrality shows how important a theme is in connecting with other topics in the field, while density shows how well-developed a theme is within its own cluster. Moreover, it is divided into four quadrants: motor, basic, niche, and emerging or marginal categories (Sharafuddin and Madhavan, 2020).

The results show that motor themes such as Sustainability, Future Generation, Intergenerational Conflicts and Family are highly developed and central to the field, indicating that these are driving and influential topics (figure 4). Basic themes including Future Design, Climate Change and Intergenerational Sustainability are central but less developed, representing foundational areas that require further investigation. Niche themes such as Generativity, Generations, Family Firm, Intergenerational Cooperation and Fiscal Sustainability are well-developed but relatively isolated from the broader research network, suggesting specialized areas of technical or contextual interest. Finally, emerging themes like Intergenerational Altruism and Generation Y show low centrality and development, indicating new, underexplored, or possibly declining areas of research.

The SDG year heatmap was created in Python (figure 5), showing publications linked to the 17 Sustainable Development Goals. The strongest connections are with SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 16 (Peace, Justice and Strong Institutions). Less attention is given to SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities), showing that social and economic equity are still less explored. Together, the thematic and SDG results show that current research focuses mainly on environmental and institutional issues, with growing interest in behavioral and economic aspects that connect daily actions with long-term sustainability.

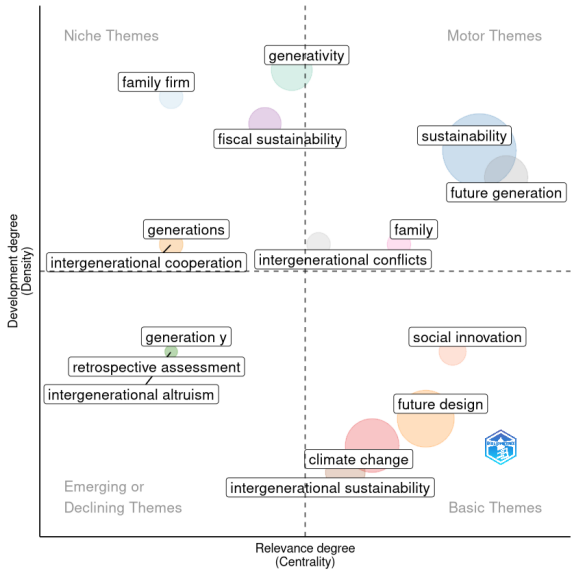

Figure 4: The thematic map focuses on future generations and intergenerational sustainability towards SDGs

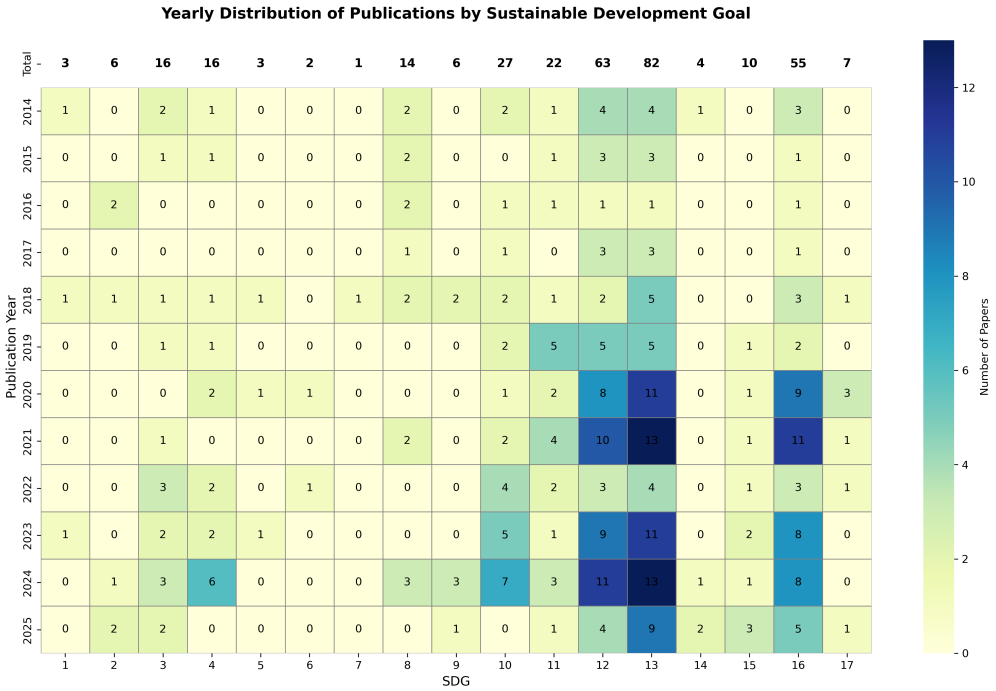

Figure 5: The heat map showing yearly publications towards SDGs

3.1.3 Synthesis and Link to Content Analysis

The bibliometric results show that research on Future Generations and Intergenerational Sustainability towards SDGs has grown steadily in recent years. Publications are led by a small yet

influential group of scholars and institutions concentrated in developed economies, particularly Japan. The analysis highlights a strong thematic focus on Future Design, Sustainability and Intergenerational Sustainability, reflecting the field's behavioral and institutional orientation supported by experimental and deliberative approaches to long-term policy design. However, participation from developing regions remains limited and research continues to focus largely on environmental and institutional aspects. Economic and social dimensions such as poverty reduction, equity and welfare distribution are still underexplored. This imbalance suggests that the field is evolving toward a comprehensive and globally inclusive understanding of intergenerational sustainability.

Expanding cross-regional and interdisciplinary collaboration can bring diverse perspectives to this field. Involving researchers from developing countries can improve its policy and economic relevance for achieving the SDGs. Such collaboration helps connect behavioral, social and economic aspects of sustainability. It also makes research findings useful for inclusive and long-term policy actions. Based on these bibliometric findings, the following content analysis (Section 3.2) explores how interventions and policies can shape behaviors and decisions toward the SDGs through cognitive, noncognitive and socioeconomic factors.

3.2 Content Analysis

Figure 6 presents a proposed conceptual framework synthesizes the FG-IS-SDGs nexus by illustrating how interventions and policies can shape behaviors and decisions drive long-term SDGs achievement through cognitive, noncognitive and socioeconomic factors.The framework identifies six behavioral orientations grouped into three sets: (1) generative and inquisitive behaviors, (2) sustainable and cooperative behaviors and (3) creative and productive behaviors. These behaviors operate through cognitive factors(automatic and deliberative processes) and are shaped by noncognitive factors and socioeconomic conditions, including culture, institutions and governance. The framework also highlights interventions and policies mechanisms, such as Future Design, prospective and retrospective perspective-taking, and AI agents, that can activate deliberative cognitive processes for long-run behavioral changes. Article codes (A01–A92) and review

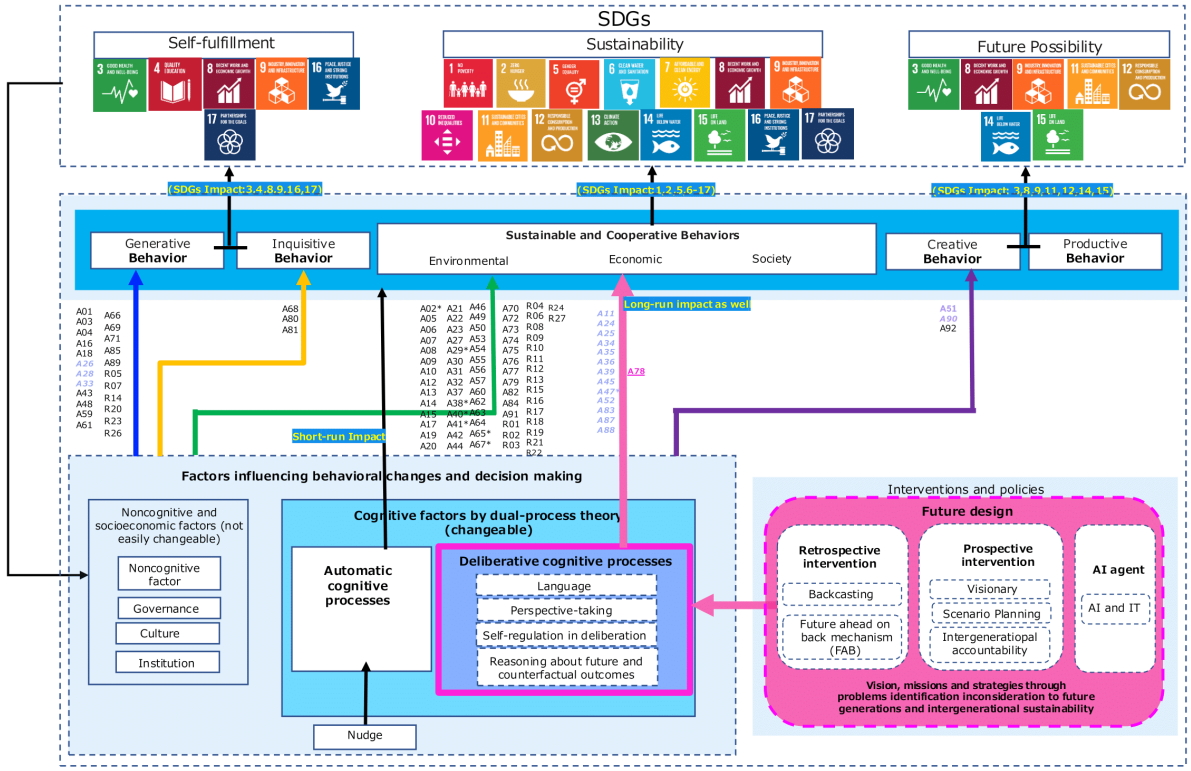

Figure 6: Proposed conceptual framework explaining how behavioral, cognitive and interventions pathways drive long-term SDGs achievement

codes (R01–R27) indicate empirical studies and review papers for each behavioral orientation, with one code representing one study on a specific behavior. The literature concentrates on sustainable and cooperative behaviors, followed by generative and inquisitive behaviors, whereas creative and productive behaviors remain underexamined.

Cognitive factors mediate behaviors through two temporal pathways following dual-process theory (Evans and Stanovich, 2013). Black arrows indicate short-run impacts from automatic cognitive processes (habits, heuristics, emotional reactions). Pink arrows indicate long-run impacts from deliberative cognitive processes (language, perspective-taking, self-regulation in deliberation, reasoning about future and outcomes). Pink-shaded boxes identify research employing deliberative processes through interventions. Structural factors (governance, culture, institutions and noncognitive traits) constrain or enable these pathways.The three behavioral sets connect to distinct SDG categories. Generative and inquisitive behaviors drive self-fulfillment SDGs (3, 4, 8,

9, 16, 17) through education, mentoring and institutional development (Hirose et al., 2023, Perez-Encinas et al., 2021). Sustainable and cooperative behaviors address sustainability SDGs (1, 2, 5-17) through resource conservation and equitable development (Pandit et al., 2021, Mostafizur et al., 2025). Creative and productive behaviors enable future possibility SDGs (3, 8, 9, 11, 12, 14, 15) through innovation and sustainable production (Jiang et al., 2023, Nakawake and Kobayashi, 2024). Interventions and policies (backcasting, FAB, scenario planning, intergenerational accountability) activate deliberative pathways toward integrated strategies (Timilsina et al., 2020, Hara et al., 2023). The following subsections detail each component.

3.2.1 Generative and Inquisitive Behaviors

Generative and inquisitive behaviors represent complementary psychological orientations that enable intergenerational sustainability. Generativity refers to concern for establishing and guiding future generations through creating, maintaining and offering to others (Erikson, 1963, McAdams and Aubin, 1992). It encompasses the desire and commitment to contribute to young generations' well-being and leave a positive legacy beyond one's lifetime (McAdams and Aubin, 1992). Generative behavior operationalizes this construct through concrete acts to support and guide young people and to benefit future generations (Millová and Blatný, 2018). Inquisitiveness represents curiosity, eagerness to learn, active questioning and critical analysis (Baehr, 2015). Inquisitive behavior manifests as the act of an individual showing curiosity and openness towards new ideas, perspectives and experiences (Hirose and Kotani, 2022). Unlike passive curiosity, it involves relentless pursuit of understanding not merely "what" but "why" and "how" phenomena occur. These behaviors complement each other through distinct yet synergistic mechanisms. Generativity provides motivational foundation through caring, the emotional concern and commitment to future generations that drives action beyond self-interest (Keyes and Ryff, 1998). Inquisitiveness supplies the learning mechanism, the cognitive capacity and motivation to explore, question, and understand complex sustainability challenges. Empirical evidence demonstrates that people with high inquisitiveness tend to be more generative and inquisitiveness serves as both direct and

indirect determinant of well-being through mediation by generativity (Hirose and Kotani, 2022, Hirose et al., 2023). Caring without learning may lack direction and effectiveness, while learning without caring may fail to motivate action toward intergenerational goals. Integrating both orientations creates a complete behavioral profile for addressing sustainability dilemmas requiring moral commitment to future generations and cognitive capacity to develop effective solutions.

Generative and inquisitive behaviors are closely related to SDG 3 (Health), SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 16 (Peace, Justice and Strong Institutions) and SDG 17 (Partnerships). Generativity correlates with psychological well-being and life satisfaction, advancing individual health outcomes while motivating investment in future health and social infrastructure (Ackerman et al., 2000, Grossbaum and Bates, 2002, Shahen et al., 2019, Hirose and Kotani, 2022). Inquisitiveness enhances happiness both directly and indirectly through generativity (Hirose et al., 2023). SDG 4 benefits most directly from these behaviors, as inquisitiveness and generativity promote lifelong learning, critical thinking and value transmission across generations(Hirose and Kotani, 2022, Hirose et al., 2023, Hirose, 2024). Strengthening these traits through intergenerational learning can build resilient communities and support sustainable education, particularly in rural and marginalized areas (Hirose, 2025). Generativity develops through positive socialization in families, schools and communities reinforces SDG 4, 8, 16 and 17 by cultivating curiosity, empathy, responsibility and cooperative engagement (Jones and McAdams, 2013). Together, inquisitiveness and generativity nurture well-being, civic responsibility and social cohesion essential for intergenerational sustainability.

Generative and inquisitive behaviors manifest across multiple social contexts. Within families, generativity appears through succession planning and value transmission, with family businesses showing higher eco-certification adoption when intergenerational succession intentions exist (Delmas and Gergaud, 2014). Cultural capital transmission enhances identity through parents' participation in cultural practices (Li et al., 2024). Question-answer exchanges between generations significantly impact children's development, with positive adult responses encouraging inquisitiveness and enhancing happiness more than generativity during childhood (Hirose, 2024).

However, farm succession faces challenges as individualization trends diminish future farming interest (Chiswell, 2018, Leiß and Zehrer, 2018). In education, inquisitiveness strongly predicts generativity, with happiness positively associated with both traits and generativity mediating the inquisitiveness-happiness relationship (Hirose and Kotani, 2022). These relationships hold even in traditional matrilineal societies, with inquisitiveness influencing wellbeing both directly and indirectly through generativity (Hirose et al., 2023). However, young people report disillusionment as education systems prioritize employability over planetary needs (Biswas, 2023). Intergenerational knowledge sharing reveals information asymmetry, with Gen Z facing challenges sharing modern sustainability knowledge with older generations (Tse, 2024). Visual narratives significantly shift preferences toward future-beneficial choices by motivating perspective-taking (Nakagawa and Saijo, 2021).

In communities, generativity expresses through volunteerism and civic action. Co-creation methods in public space design enhance intergenerational relationships by fostering communication and reducing stereotypes (Wu et al., 2022). High-quality intergenerational contact involving perspective-taking explains older participants' climate protection intentions, with legacy motivation positively related to climate protection (de Paula et al., 2024). In workplaces, orientations surface in mentoring and sustainability programs. New entrants in mountain farming demonstrate generative capacity by revitalizing abandoned farms despite lacking family farming backgrounds (Grüner and Konzett, 2024). Businesses without intergenerational succession intention pursue eco-certification symbolically rather than for true sustainability (Delmas and Gergaud, 2014). Cross-cultural expressions vary substantially. Rural populations exhibit higher generativity due to stronger social networks, whereas urbanization weakens generativity as interactions become superficial (Timilsina et al., 2019). The inquisitiveness-generativity-wellbeing relationships remain significant even in traditional societies with different cultural structures, suggesting robustness across diverse sociocultural context (Hirose et al., 2023). Climate activism demonstrates bidirectional compassion, with older activists engaging in policy lobbying while younger activists prioritize awareness and education, though cultural factors influence approaches (Roy and Ayalon,

2024).

Research demonstrates robust effects for several practices. Inquisitiveness-generativity linkage shows consistent patterns, with inquisitiveness significantly predicting generativity and serving as both direct and indirect determinant of wellbeing (Hirose and Kotani, 2022, Hirose et al., 2023, Hirose, 2024). FAB intervention successfully influences sustainable decisions by inducing cognitive dissonance, changing both behaviors and motivational factors (Shahen et al., 2020, 2021). Visual narratives effectively shift preferences by inducing regret prevention motivations (Nakagawa and Saijo, 2021). However, proxy voting alone proved insufficient without complementary mechanisms (Miyake et al., 2023). Critical gaps persist. Long-term tracking remains severely limited, with studies failing to track effects over months or years (Wu et al., 2022, Grüner and Konzett, 2024). Longitudinal studies following children to observe how inquisitiveness and adult responses influence development would address trajectories (Hirose et al., 2023, Hirose, 2024). Cross-cultural applications remain underexplored, requiring testing across diverse contexts (Hirose and Kotani, 2022, Hirose, 2024, Li et al., 2024, Tse, 2024). Causal mechanisms require deeper investigation using experimental designs and neuropsychological approaches (Shahen et al., 2021, Hirose and Kotani, 2022). Developing interventions fostering inquisitiveness and assessing impacts on generativity represents actionable direction (Hirose and Kotani, 2022). Institutional embedding remains insufficiently examined, requiring integration of autonomy and inquisitiveness into national sustainability programs(Shahen et al., 2021, Hirose et al., 2023). Expanding measures to include behavioral assessments and exploring different adult-child interaction types would strengthen research (Hirose, 2024).

Future research should employ experimental and longitudinal designs to assess whether interventions and policies that activate deliberative cognitive processes generate long-run changes in behaviors and decisions toward the SDGs. Field studies can test whether interventions that target underexamined orientations, especially inquisitive, creative and productive behaviors, produce durable effects beyond the commonly studied generative, cooperative and sustainable behaviors, while randomized and natural experiments can identify effective modalities and real-world

impacts across contexts. Advances in measurement are essential. SDG-relevant behavioral and decision scales that are validated across cultures, combined with mixed-methods designs and behavioral data, can improve comparability and reduce reliance on short-run self-reports. Scalable interventions include community programs that enable intergenerational deliberation, household or family-based reflection activities and workplace learning programs that connect problem-solving with sustainability goals. Digital tools such as virtual reality for future perspective-taking, AI-assisted reflection prompts and online deliberation platforms can expand reach, but they require rigorous evaluation of engagement depth and persistence of effects. Integrating sustainability and intergenerational perspectives in education and strengthening institutional arrangements that represent future generations in decision-making can support sustained impacts. Future studies should also assess cultural adaptation, cost-effectiveness, unintended effects and equity in access. Comparative and systems-oriented research that links behavioral interventions with governance, infrastructure and incentives remains critical, because long-run progress toward the SDGs requires both behavioral mechanisms and enabling socioeconomic and institutional conditions.

3.2.2 Cooperative and Sustainable Behaviors

Cooperative and sustainable behaviors are among the most extensively studied domains in intergenerational sustainability research because they capture the central tension between immediate individual benefit and long-term collective welfare. Cooperative behavior refers to individuals or groups working together toward a common goal, ensuring that no group benefits at the expense of others. Sustainable behavior involves protecting the environment and supporting social well-being through responsible actions (Corral-Verdugo and Frías-Armenta, 2016). This tension becomes evident when individuals make extraction decisions alone, where resources are often depleted as a small minority takes excessive amounts (Hauser et al., 2014). The intergenerational sustainability dilemma (ISD) framework illustrates this challenge, as current generations must choose between maximizing their own payoffs or preserving resources for future generations who cannot reciprocate or sanction current decisions. The centrality of cooperation in this literature lies in its direct

relevance to human survival. Futurability, the capacity to envision and act for sustainable futures, is essential since short-term self-interest leads to resource depletion and potential extinction (Saijo, 2024). Traditional altruism is insufficient; sustainability depends on belief systems that gain value over time, where confidence in growing intergenerational assets encourages stronger conservation (Kobayashi and Chiba, 2020). This broader framework integrates social justice, environmental justice and intergenerational equity as key conditions for long-term well-being (Summers and Smith, 2014).

Cooperative and sustainable behaviors directly influence SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 16 (Peace, Justice and Strong Institutions). However, a critical gap exists between sustainability feasibility and actual intergenerational welfare simply ensuring sustainability is not enough if future generations lack the means to maintain it. Political, economic and institutional constraints shape sustainability feasibility, with more constraints making it harder to ensure sustainability for future generations (Fleurbaey, 2015). Current SDGs inadequately address the needs of distant future generations, primarily focusing on minimal goods distribution among present populations. Proposed sub-targets based on intergenerational sufficientarianism could enhance SDG effectiveness by ensuring that wellbeing thresholds are set for both proximal and distant FG (Oliveira, 2018). Psychological factors further complicate SDG engagement: mortality salience reduced perceived importance of socially related SDGs while leaving ecologically related SDGs unaffected (Hu et al., 2018), suggesting different SDG dimensions engage distinct psychological processes requiring tailored interventions. Operationalizing these connections remains challenging. Bithas (2020) proposes using ecological thresholds as observable and measurable indicators for sustainability policy that ensure environmental rights of future generations. However, tensions exist between intergenerational and intragenerational equity, where prioritizing FG can affect current socio-economic inequalities (Spijkers, 2018).

Cooperative and sustainable behaviors are strongest in communities with high social cohesion and intergenerational trust. Rural participants consistently choose sustainable options more often than urban participants, reflecting stronger prosocial norms and collective responsibility (Shahrier

et al., 2017). Urban environments shaped by competition and self-interest weaken cooperation and reduce concern for future generations (Timilsina et al., 2021). Socio-spatial and cultural settings further influence these patterns. In China, residents of plains and hilly regions show more self-oriented preferences than those in mountainous areas, indicating that local environments shape cooperation (Jingchao et al., 2021) . In the United Kingdom and China, sustainability is understood differently. People in Sheffield focus on social and economic well-being, while those in Nanjing emphasize environmental responsibility through state narratives, yet both display limited concern for distant futures (Diprose et al., 2019). Generational and occupational contexts also matter. Young adults express strong concern for climate change but engage less in demanding sustainable practices because of economic constraints (Stanes et al., 2015). Older groups show more consistent long-term stewardship values (Zhang, 2018). In agriculture, generativity appears through mentoring and community contribution rather than inheritance alone (Conway et al., 2016, Downey et al., 2016). Overall, cooperative and sustainable behaviors thrive where shared identity, mutual trust and intergenerational responsibility are embedded in community life and local institutions.

Public goods and intergenerational experiments reveal that cooperation across generations depends on social context, deliberation and accountability mechanisms. The Imaginary Future Generations (IFG) treatment substantially increased sustainable choices, with 60 percent of participants selecting sustainable options compared to 28 percent without it (Kamijo et al., 2017). IFG was most effective when prosocial individuals were absent, suggesting that taking a future-generation perspective can induce sustainability even without altruistic motives. Voting and deliberation mechanisms also strengthen cooperation. Median voting and Deliberative Majority Voting improve sustainability by allowing participants to reflect on fairness and future consequences (Hauser et al., 2014, Koirala et al., 2021, Balmford et al., 2024). When deliberation is combined with accountability, as in Majority Voting with Deliberative Accountability (MVDA), cooperation and fairness increase further (Koirala et al., 2021). Future Design (FD) provides the most comprehensive evidence. Participants debating from the perspective of future generations show increased empathy and prioritize sustainable policies that preserve future freedom of choice (Hara et al., 2019, 2021).

Intergenerational Accountability (IA) strengthens moral commitment and fairness concerns, reducing psychological distance between generations (Timilsina et al., 2023).

Beyond laboratory settings, several studies show evidence of behavioral persistence. Future Design interventions increase organic consumption and reduce nonorganic purchases over repeated rounds (Mostafizur et al., 2025). Perspective-taking promotes long-term support for sustainable waste management and climate action (Pandit et al., 2021, Fornwagner and Hauser, 2022). Neuropsychological studies link sustainable behavior to brain regions responsible for empathy and self-control. It shows that cognitive and emotional capacities jointly shape long-term cooperation (Guizar et al., 2022, Baumgartner et al., 2023). Retrospective treatment also enhances sustainable preferences by encouraging reflection on past decisions (Nakagawa et al., 2019b,a). Soft institutional interventions, such as advisory mechanisms, promote sustainability even without enforcement, while fragmented or inconsistent narratives weaken behavioral continuity (Guida et al., 2025). Overall, experimental and field evidence demonstrates that cooperative and sustainable behavior toward future generations can be sustained when deliberation, accountability and cognitive engagement are combined with institutional and social reinforcement.

Most studies on cooperative and sustainable behaviors focus on short-term or individual-level outcomes because experiments are often designed to isolate immediate responses under controlled settings. While these approaches clarify how people cooperate or act sustainably in simplified dilemmas, they capture only transient effects and overlook how behavioral change evolves through repeated interaction, institutional support and social learning (Lohse and Waichman, 2020, Timilsina et al., 2022). The absence of longitudinal and institutional perspectives limits understanding of how cooperation and sustainability become stable social norms. Future research should bridge behavioral processes and institutional mechanisms to sustain cooperative and prosocial choices. Rules, incentives and participatory governance structures can support long-term cooperation when combined with trust, communication and shared accountability (Katsuki and Hizen, 2020, Inoue et al., 2023). Field experiments that embed deliberation and intergenerational accountability within communities, workplaces and local policies are needed to test persistence beyond the laboratory

(Kamijo et al., 2017, Koirala et al., 2021). Integrating behavioral economics with interventions and policies through education, digital participation and intergenerational identity formation can strengthen collective responsibility for the future . Long-term sustainability depends on aligning internal motivations for cooperation with external structures that reinforce fairness, empathy and trust as continuous social practices.

3.2.3 Creative and Productive Behaviors

Creative and productive behaviors expand the intergenerational sustainability framework by explaining how societies generate and apply innovative solutions to complex challenges. While cooperative and sustainable behaviors emphasize preserving existing resources, creative and productive behaviors focus on innovation, adaptability and knowledge transmission across generations. Creative behavior refers to the generation of original and useful ideas or designs through problem-solving and invention, free from internal or external constraints (Cabra and Uribe, 2013). Productive behavior involves taking effective actions that produce positive results and meaningful outcomes. Together, these behaviors link creativity with implementation, enabling societies to develop new capacities and institutions rather than depending solely on inherited assets, thereby strengthening intergenerational resilience. Future Design studies show that adopting future-generation perspectives stimulates insight problem-solving and paradoxical thinking, allowing participants to reframe "wicked" sustainability problems and generate transformative ideas (Nakagawa, 2020). Innovation and exploration increase when incentives are linked to future benefits, demonstrating the need for interventions and policies that align individual rewards with collective intergenerational gains (Nakawake and Kobayashi, 2024). Creative engagement also fosters intrinsic motivation through intellectual joy, reducing present bias and encouraging long-term reflection (Nakagawa, 2020). Integrating systems thinking with imaginary future generations (IFG) further enhances futurability. Participants develop innovative and system-level proposals, shifting from incremental solutions to structural approaches that support long-term goals such as decarbonization (Hara et al., 2023). Together, these processes highlight creativity as a critical foundation for IS.

Creative and productive behaviors advance several Sustainable Development Goals (SDGs), including SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). For SDG 13, the combination of Imaginary Future Generations and systems thinking enabled Kyoto City to design long-term decarbonization strategies, illustrating how creative engagement can overcome short-term political and economic barriers (Hara et al., 2023). In SDG 6 contexts, Future Design workshops fostered original thinking in water management, revealing how structured creativity enhances collective mission and responsibility (Nakagawa, 2020). Productive behaviors supporting SDG 9 link exploration and innovation to future benefits, showing that incentive systems aligning individual rewards with collective outcomes encourage sustainable technology development (Nakawake and Kobayashi, 2024). Integrating creative ideation with productive execution enables societies to identify synergies among SDGs, reduce trade-offs and strengthen institutional capacity for lasting intergenerational sustainability.

Research linking creativity with intergenerational sustainability remains limited compared to cooperative and sustainable behaviors. Existing studies focus mainly on local governance, innovation systems and education. In local governance, Future Design workshops enabled municipal officials to adopt 2050 perspectives as Imaginary Future Generations (IFG), applying systems thinking to develop decarbonization strategies in Kyoto City (Hara et al., 2023). Similarly, nine water management officers participated in seven workshops using cognitive mapping to visualize thought processes (Nakagawa, 2020). These settings provide fertile ground for testing creative approaches, complementing evidence that deliberation fosters intergenerational concern in ecosystem service valuation (Mavrommati et al., 2020). In innovation contexts, laboratory experiments on virtual tool design found that linking rewards to future-generation outcomes enhances exploration and knowledge transfer (Nakawake and Kobayashi, 2024), aligning with policy efforts to promote green innovation and accountability for intergenerational externalities (Jiang et al., 2023).

Creative and productive behaviors for sustainability vary across workplaces, households and

communities, reflecting distinct opportunities and constraints. In workplace contexts, causal loop diagrams helped participants think more holistically and systematically in policy design. However, expert-created rather than participant-created diagrams limited engagement (Hara et al., 2023). Professional homogeneity supports shared technical understanding but may restrict generalizability (Nakagawa, 2020). Deconstructing hierarchy promotes constraint relaxation, suggesting that organizational status differences can inhibit creative thinking about transformative change (Nakagawa, 2020).

In household and community contexts, creativity connects to intergenerational value transmission. Generation Y households show widening value–action gaps driven by housing tenure and labor market conditions, indicating structural limits to household innovation (Stanes et al., 2015). Lifelong and reverse learning processes shape food consumption, showing households as adaptive spaces where generations co-develop new practices (Carrigan et al., 2023). Cultural and economic variations also shape creativity. Sheffield emphasizes social and economic aspects, while Nanjing stresses environmental responsibility through state-led narratives (Diprose et al., 2019). Economic precarity reduces exploration, as unrepaid conditions lower intrinsic motivation for innovation benefiting future generations (Nakawake and Kobayashi, 2024). Effective environments combine temporal distance, accessible tools, psychological safety, iterative engagement and tangible incentives (Nakagawa, 2020). Yet most evidence remains Japan-centered, requiring broader cross-cultural validation.

Creative and productive behaviors remain underrepresented due to weaker links to established behavioral economics traditions, greater measurement difficulty, long evaluation horizons and sustainability discourses emphasizing sacrifice over creativity. Methodological challenges persist. Kyoto's study lacked quantitative validation (Hara et al., 2023), water management relied on post-hoc cognitive mapping (Nakagawa, 2020) and technology experiments used simplified two-generation settings (Nakawake and Kobayashi, 2024). Future work should combine participatory deliberation with quantitative assessment, expand across contexts and involve cross-disciplinary participants. Scaling and replication require larger workshops where participants create their own

causal loop diagrams and test cognitive mapping for real-time feedback (Nakagawa, 2020, Hara et al., 2023). Extending to multi-generation settings may clarify institutional interactions (Rose, 2024b). Domain expansion into circular economy, food systems and energy can test transferability (Nakagawa, 2020, Hara et al., 2023). Studying incentive structures, including prestige or community reward systems, can identify scalable institutional designs (Bogacki and Letmathe, 2021, Nakawake and Kobayashi, 2024). Future research should also explore cognitive mechanisms such as intellectual joy and paradoxical thinking (Nakagawa, 2020) and interactions between creative, cooperative and sustainable behaviors. Cross-cultural, longitudinal validation remains essential for real-world applicability.

3.2.4 Factors Influencing Behavioral Changes and Decision Making

Behavioral change toward IS depends on both non-cognitive factors and cognitive factors, rooted in dual-process theory that distinguishes between automatic and deliberative thinking systems. Non-cognitive factors encompass institutions, governance structures, cultural values, personality traits and demographic characteristics that shape the context within which individual cognitive processes operate (Evans and Stanovich, 2013, Chater and Loewenstein, 2023). These dimensions determine how individuals form intentions and act within structural and social systems, providing the foundation for interventions addressing FG and SDGs challenges. Institutional factors significantly shape behavioral change through formal rules, enforcement mechanisms and organizational structures. Research demonstrates that country-level governance factors such as government effectiveness, regulatory quality and rule of law drive firms' commitment to sustainability practices through institutional pressures (Naciti et al., 2022, Galleli and Amaral, 2025). The World Bank identifies six dimensions of governance indicators affecting sustainability: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law and control of corruption (Kaufmann and Kraay, 2024). Among these, rule of law consistently drives corporate sustainability performance. Studies show that legal infrastructure and property rights improve environmental outcomes, with efficient governance ensuring coun-

tries progress by establishing effective resource management(Panayotou, 1997, Atta and Sharifi, 2024).

Cultural values represent another critical non-cognitive influence on sustainability behavior. Research using dimensions demonstrates that national culture profoundly affects corporate sustainability practices and individual pro-environmental behaviors. Culture affects both cognition and norms by influencing how people perceive environmental issues and what behaviors are socially valued (Miska et al., 2018, Ordonez-Ponce, 2023). Demographic and socioeconomic factors further influence cooperation and sustainability. Rural communities display higher prosociality than urban groups due to stronger social capital and lower market dependence. Economic development affects willingness and capacity to engage in sustainable behaviors, raising concerns over equity and distributional impacts.Personality traits and individual differences constitute another layer of non-cognitive influences. Research demonstrates substantial individual variation in prosocial orientations, risk preferences, time preferences and environmental values that predict sustainability behaviors independent of external contextual factors (Hauser et al., 2014, Shahrier et al., 2017). Effective interventions should therefore target diverse motivational profiles rather than assuming uniform responses.Cross-country comparisons show that governance and culture jointly explain differences in sustainability practices. Nations with stronger governance and participatory cultures, such as the UK and Malaysia, report higher CSR engagement than countries with weaker institutions (Adnan et al., 2018).Broader analyses show that cultural dimensions shape environmental outcomes in complex ways. Masculinity and power distance often correlate with poorer environmental performance, while individualism supports institutional capacity and innovation(Park et al., 2007, Dangelico et al., 2020, Huang et al., 2022). Long-term orientation promotes better environmental and human development results, though effects of uncertainty avoidance and indulgence remain debated (Ioannou and Serafeim, 2012, Sedita et al., 2022).

Dual-process theory explains how automatic and deliberative cognition jointly shape sustainability behavior (Evans, 2008, Evans and Stanovich, 2013, Kahneman, 2011). Automatic processes (type 1) are fast, intuitive and emotion-driven, whereas deliberative processes (type 2) are reflec-

tive, controlled and effortful. Evans (2008) identifies four defining features of deliberative cognition, such as language, reflective consciousness, higher-order control and the capacity to think hypothetically about future and counterfactual possibilities which enable reasoning about long-term goals and intergenerational outcomes. Neuroscientific studies confirm this distinction: the default mode network supports intuitive thinking, while executive control regions enable deliberation and self-regulation (Gronchi and Giovannelli, 2018, Vatansever et al., 2017). In sustainability contexts, these features correspond to language, perspective-taking, self-regulation and reasoning about future and counterfactual outcomes. Language facilitates intergenerational dialogue; perspective-taking (as in FAB) strengthens empathy and moral concern; self-regulation aligns immediate impulses with long-term goals; and reasoning supports the evaluation of uncertainty and trade-offs (Shahrier et al., 2017, Shahen et al., 2021, Baumgartner et al., 2023). FD activates these deliberative capacities through structured temporal reflection. FD participants adopt past, present, and future perspectives to build coherent long-term narratives, reducing time inconsistency and fostering sustained behavioral change (Mostafizur et al., 2025).

Automatic interventions, such as nudges, can encourage short-term behavioral change but often lose effectiveness over time because of habituation or reduced intrinsic motivation (Deci and Ryan, 2000, Sunstein, 2015, Loewenstein and Chater, 2017). Deliberative approaches, including reflective dialogue, transparency-based nudges and participatory decision-making, foster intrinsic motivation and stable value orientations (van Gestel et al., 2021, Bamberg and Möser, 2007). The most effective strategies combine both systems: automatic cues initiate action, while deliberation consolidates it through reflection and moral reasoning. Examples include default green-energy enrollment paired with education sustaining participation and intergenerational deliberation reinforcing prosocial norms and cooperation (Marteau et al., 2012, Timilsina et al., 2021). Overall, behavioral change emerges when automatic reactions are guided and stabilized by deliberative processes that engage language, perspective-taking, self-regulation in deliberation and reasoning about future and outcome,core cognitive foundations for IS.

Cognitive and non-cognitive factors interact across institutional, cultural and social contexts

to shape sustainability behavior. Cognitive processes operate within these environments, which can either enable or constrain how individuals deliberate and act toward intergenerational goals. In education, sustainability outcomes depend on the alignment between institutional design and cognitive engagement. Programs integrating critical reflection with supportive learning environments enhance competencies for long-term thinking (Hüfner, 2000). Cultural norms influence pedagogy: high power distance favors teacher-centered learning, while participatory models flourish in low-hierarchy, future-oriented cultures (Hofstede, 2001, House et al., 2004). In households, value transmission occurs through communication and role modeling. Dialogue across generations can reshape habits, though time pressure and financial constraints limit deliberative reflection (Mullainathan and Shafir, 2013, Essiz and Mandrik, 2022).

In workplaces, leadership, culture and institutional conditions jointly determine whether cognition operates automatically or deliberatively. Transformational leadership engages both modes by aligning shared values with conscious reasoning (Farrukh et al., 2022). Cultural and institutional contexts moderate these effects: strong institutions and stable governance reduce cognitive burden and promote habitual cooperation (Panayotou, 1997), whereas weak governance increases uncertainty and requires reflective reasoning (North, 1990). Collectivist cultures foster prosociality through automatic socialization, while individualist contexts depend on deliberate cultivation of shared responsibility (Triandis, 1995). Under resource scarcity, survival pressures trigger intuitive reactions but also stimulate creative problem-solving (Evans and Stanovich, 2013, Mullainathan and Shafir, 2013). As argued by Cerulo et al. (2021), cognition is embedded in social, institutional, and material environments that shape how individuals think and act. Taken together, these findings demonstrate that sustainability behavior emerges from the interaction between automatic socialization and deliberative reflection, structured by educational, organizational and cultural contexts that condition how individuals learn, decide and act toward intergenerational well-being.

Future research needs to integrate cognitive and structural perspectives using multi-level and cross-cultural models. Hierarchical and longitudinal approaches can clarify how institutions and cultures shape cognition and how interventions lead to lasting behavioral change. Behavioral eco-

logical economics offers a systems perspective linking cognitive processes with institutional dynamics for sustainable transitions (Drews, 2025). Models should reflect cultural, socioeconomic, and age-related diversity since these factors influence cognitive effects (Shahrier et al., 2017, Miska et al., 2018). Limited cognitive resources reduce the effectiveness of deliberative interventions among vulnerable populations(Mullainathan and Shafir, 2013). Participatory and context-sensitive approaches that combine analytical rigor with inclusivity are needed to design frameworks that promote IS (Ostrom, 2009).

3.2.5 Interventions and Policies

Future-oriented interventions and policies have been developed to influence people's concern for future generations and intergenerational sustainability. Research applies structured decision environments such as the Intergenerational Sustainability Dilemma (ISD), the Intergenerational Sustainability Dilemma Game (ISDG) and the Intergenerational Goods Game (IGG) to examine mechanisms including Future Design (FD), Imaginary Future Generations (IFG), Future Ahead and Back (FAB) and Intergenerational Accountability (IA) (Hauser et al., 2014, Shahrier et al., 2017). These studies demonstrate that behavioral interventions can complement structural and policy changes by addressing psychological and motivational barriers that regulations alone cannot solve ((Evans and Stanovich, 2013). FD, developed at Kochi University of Technology, is a comprehensive deliberative framework designed to enable people to think from the perspectives of past, present and future generations (Nakagawa and Saijo, 2020b, Saijo, 2020, 2024). The framework activates "futurability," or the ability to envision and act for sustainable futures. Within FD, three main types of interventions such as retrospective, prospective and AI-assisted. It helps participants develop visions, missions and strategies through structured problem identification. Key factors influencing outcomes include location (rural populations show higher sustainability choices due to stronger prosocial norms), age (intergenerational diversity enhances outcomes through "creative friction"), cognitive traits (generativity, critical thinking, self-control) and social dynamics (prosocial tendencies, accountability responsiveness) (Shahrier et al., 2017, Timilsina et al., 2019, Hirose

and Kotani, 2022).

Retrospective approaches such as backcasting and the Future Ahead and Back (FAB) mechanism guide participants to learn from the past and imagine sustainable futures. Backcasting identifies a desirable long-term goal and then traces backward to determine the steps required to reach it Timilsina et al. (2020). The FAB mechanism advances this idea by introducing temporal perspective-taking through three steps: (1) analyzing a current problem, (2) adopting the perspective of future generations to propose strategies and (3) returning to the present to integrate future requests into current actions. This process encourages logical reasoning and empathy, helping participants consider the emotions and expectations of future generations (Shahrier et al., 2017). Experimental results show that FAB can shift individuals from self-interested to sustainable choices, particularly among rural participants, older people and those with higher generativity (Nakagawa et al., 2019b,a).

Prospective interventions include visioning, scenario planning and intergenerational accountability. These approaches encourage reflection on future possibilities and help participants articulate long-term aspirations. Visioning creates shared images of desirable futures, while scenario planning explores alternative pathways under uncertainty (Hara et al., 2023, Timilsina et al., 2023). . Intergenerational accountability strengthens moral responsibility by asking current generations to justify their choices to future ones. Empirical studies show that these interventions have been implemented in municipalities, educational institutions and organizations. Kyoto City has integrated IFG and systems thinking into participatory processes for its 2050 decarbonization plan (Hara et al., 2019, 2023). Similar approaches have been introduced in rural communities, universities and corporate settings to encourage long-term thinking (Bogacki and Letmathe, 2021, Perez-Encinas et al., 2021). Visual and narrative tools also make abstract future impacts tangible (Nakagawa and Saijo, 2021).

Emerging studies explore the potential of artificial intelligence (AI) and digital foresight tools to enhance intergenerational decision-making. AI-based simulations, predictive analytics and virtual-reality environments can expand deliberation by visualizing long-term consequences and

connecting imaginary future representatives (Nakawake and Kobayashi, 2024). These technologies may improve accessibility and engagement, yet they raise ethical and institutional challenges, such as algorithmic bias, transparency, legitimacy and environmental costs associated with high-energy computing (Hauser, 2025). Within the FD framework, AI serves as an amplifier of human reasoning and empathy rather than a replacement, supporting participants in understanding inter-generational trade-offs.

FD integrates retrospective, prospective and AI-based mechanisms into a unified deliberative process. Its effectiveness depends on social and cognitive conditions. Rural participants tend to make more sustainable choices due to stronger social norms. Age-diverse groups often produce better results through "creative friction." High levels of generativity and self-control also contribute to more consistent long-term decisions (Shahen et al., 2021, Hirose and Kotani, 2022). Field experiments indicate that FD can produce persistent behavioral changes. A three-month study in Bangladesh showed sustained increase in organic and decrease in nonorganic vegetable consumptions (Mostafizur et al., 2025). These outcomes suggest that interventions can change social norms and cognitive orientations without coercive regulation, consistent with ecological economics, which views sustainability as an evolving process of learning and deliberation.

FD interventions culminate in developing shared visions, missions and strategies through systematic problem identification (Mostafizur et al., 2025). Participants examine how present conditions arise from past choices, how current actions can become future problems and how future generations might evaluate these outcomes (Hara et al., 2023). Visioning produces long-term aspirations that integrate environmental and social objectives. Missions translate these aspirations into guiding principles and strategies operationalize them into concrete plans that consider long-term impacts (Timilsina et al., 2023). Effective outcomes depend on cognitive engagement, facilitation quality and age diversity among participants. Municipal applications such as Kyoto's FD process demonstrate that deliberative mechanisms can lead to durable policy visions when outputs are formally institutionalized (Hara et al., 2019, Nakagawa and Saijo, 2021). Overall, Future Design and related interventions demonstrate strong potential to transform short-term preferences into long-

term commitments. They enable individuals and communities to bridge temporal divides through reflection, empathy and learning, providing a behavioral foundation for intergenerational sustainability.

4 Conclusion

This paper has examined the literature on future generations (FG), intergenerational sustainability (IS) and the Sustainable Development Goals (SDGs) through a systematic review combining bibliometric and content analysis. The review shows a steady increase in research output from 2014 to 2025, with an annual growth rate of about 2.3 percent. The bibliometric analysis highlights Japan as the leading contributor, followed by the United States, China, Germany, Italy and Australia, reflecting the concentration of research in developed economies. The thematic map identifies future design, climate change and intergenerational sustainability as central but less developed areas, while generativity, intergenerational cooperation and fiscal sustainability appear as specialized themes with limited integration. The SDG mapping shows strong attention to environmental and institutional dimensions, especially SDG 12 on responsible consumption, SDG 13 on climate action and SDG 16 on peace and governance, whereas social and economic aspects such as poverty reduction, equity and welfare distribution remain limited. These findings indicate that while the field is expanding, it remains geographically concentrated and thematically uneven, calling for broader participation and stronger cross-disciplinary integration.

This study advances understanding by developing a conceptual framework that synthesizes the FG–IS–SDGs nexus and clarifies how interventions and policies can shape behaviors and decisions toward the SDGs through cognitive, noncognitive and socioeconomic factors. The framework consolidates six behavioral into three sets and links them to automatic and deliberative cognitive processes. Two insights follow. First, existing studies mainly examine interventions and policies on short-run behaviors and decisions, emphasizing generative, cooperative and sustainable behaviors while overlooking inquisitive, creative and productive ones. Second, few studies examine long-run

changes in behaviors and decisions, implying the need to study how interventions and policies influence deliberative cognitive processes for durable effects.

The framework provides guidance for translating behavioral insights into practical strategies. Policymakers can embed long-term perspectives in decision making through intergenerational deliberation and accountability mechanisms. Educational institutions can cultivate inquisitiveness and generativity through reflective and intergenerational learning. Communities and organizations can adopt future design (FD), future ahead and back (FAB) and backcasting to co-create shared vision, missions and strategies that integrate sustainability into everyday practice. Together, these applications connect behavioral pathways with long-term perspectives to promote collective action across generations.

Future research should investigate how behavioral and cognitive changes persist over time and across contexts through longitudinal and multi-level studies. Comparative and cross-cultural evidence is needed to examine the robustness of deliberative cognitive processes (DCPs) under different social and institutional conditions. Creative and productive behaviors remain underexplored and deserve more attention to clarify how innovation, technology and adaptive capacity contribute to intergenerational resilience. Digital platforms, artificial intelligence and participatory systems also hold potential for facilitating reflection, accountability and behavioral monitoring.

Achieving the SDGs requires transformation not only in policy and technology but also in human cognition, values and institutional design. Embedding concern for future generations within governance, education and community systems strengthens the behavioral foundations of sustainability and accelerates progress toward long-term well-being. Integrating deliberation, cooperation and creativity in decision making ensures that societies act with foresight, fulfilling the SDGs' central promise to advance equity and sustainability across generations.

We acknowledge several limitations. This review is limited to English-language publications indexed in Scopus and focuses on behavioral and decision mechanisms. Future studies may extend coverage to non-English and gray literature, employ quantitative meta-analysis and test the proposed framework through field experiments and policy applications. These efforts can strengthen

evidence on how interventions and policies can induce long-run changes in behaviors and decisions and accelerate progress towards the SDGs across generations.

References

Abrahamse, W. (2020). How to effectively encourage sustainable food choices: A mini-review of available evidence. *Frontiers in psychology*, 11:589674.

Ackerman, S., Zuroff, D., and Moskowitz, D. (2000). Generativity in midlife and young adults: Links to agency, communion, and subjective well-being. *The international journal of aging and human development*, 50:17–41.

Adnan, S., Hay, D., and van Staden, C. (2018). The influence of culture and corporate governance on corporate social responsibility disclosure: A cross-country analysis. *Journal of cleaner production*, 198:820–832.

Allcott, H. and Rogers, T. (2014). The short-run and long-run effects of behavioral interventions: Experimental evidence from energy conservation. *American economic review*, 104:3003–3037.

Amiri, B., Jafarian, A., and Abdi, Z. (2024). Nudging towards sustainability: A comprehensive review of behavioral approaches to eco-friendly choice. *Discover sustainability*, 5:444.

Atta, N. and Sharifi, A. (2024). A systematic literature review of the relationship between the rule of law and environmental sustainability. *Sustainable development*, 32:7051–7068.

Bagdi, T., Ghosh, S., Sarkar, A., Hazra, A., Balachandran, S., and Chaudhury, S. (2023). Evaluation of research progress and trends on gender and renewable energy: A bibliometric analysis. *Journal of cleaner production*, 423:138654.

Balmford, B., Marino, M., and Hauser, O. (2024). Voting sustains intergenerational cooperation, even when the tipping point threshold is ambiguous. *Environmental and resource economics*, 87:167–190.

Bamberg, S. and Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of environmental psychology*, 27:14–25.

Baumgartner, T., Guizar, E., and Knoch, D. (2023). Neural mechanisms underlying interindividual differences in intergenerational sustainable behavior. *Scientific reports*, 13:17357.

Bengtsson, M., Alfredsson, E., Cohen, M., Lorek, S., and Schroeder, P. (2018). Transforming systems of consumption and production for achieving the sustainable development goals: Moving beyond efficiency. *Sustainability science*, 13:1533–1547.

Biswas, T. (2023). Becoming good ancestors: A decolonial, childist approach to global intergenerational sustainability. *Children and society*, 37:1005–1020.

Bithas, K. (2020). A bioeconomic approach to sustainability with ecological thresholds as an operational indicator. *Environmental and sustainability indicators*, 6:100027.

Bogacki, J. and Letmathe, P. (2021). Representatives of future generations as promoters of sustainability in corporate decision processes. *Business strategy and the environment*, 30:237–251.

Cabra, J. and Uribe, D. (2013). Creative behavior. In Carayannis, E., Dubina, I., Seel, N., Campbell, D. F. J., and Uzunidis, D., editors, *Encyclopedia on creativity, invention, innovation, and entrepreneurship*, pages 267–271. Springer, New York, NY.

Carrigan, M., Wells, V., and Athwal, N. (2023). 'I'd never cook it now': An exploration of intergenerational transference and its role in facilitating family food sustainability. *European journal of marketing*, 57:1352–1379.

Cerulo, K., Leschziner, V., and Shepherd, H. (2021). Rethinking culture and cognition. *Annual review of sociology*, 47:63–85.

Chang, C., Kristensen, N., Le, N., Tan, C., and Carrasco, L. (2021). Having a stake in the future and perceived population density influence intergenerational cooperation. *Royal society open science*, 8:210206.

Chater, N. and Loewenstein, G. (2023). The i-frame and the s-frame: How focusing on individual-level solutions has led behavioral public policy astray. *Behavioral and brain sciences*, 46:e147.

Chiswell, H. (2018). From generation to generation: Changing dimensions of intergenerational farm transfer. *Sociologia ruralis*, 58:104–125.

Conway, S., McDonagh, J., Farrell, M., and Kinsella, A. (2016). Cease agricultural activity forever? Underestimating the importance of symbolic capital. *Journal of rural studies*, 44:164–176.

Corral-Verdugo, V. and Frías-Armenta, M. (2016). The sustainability of positive environments. *Environment, development and sustainability*, 18:965–984.

Dangelico, R., Fraccascia, L., and Nastasi, A. (2020). National culture's influence on environmental performance of countries: A study of direct and indirect effects. *Sustainable development*, 28:1773–1786.

de Paula, S., Kulcar, V., and Schmidt, K. (2024). Act like there is a tomorrow—contact and affinity with younger people and legacy motivation as predictors of climate protection among older people. *Sustainability*, 16:1477.

Deci, E. and Ryan, R. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry*, 11:227–268.

Delmas, M. and Gergaud, O. (2014). Sustainable certification for future generations: The case of family business. *Family business review*, 27:228–243.

Diprose, K., Liu, C., Valentine, G., Vanderbeck, R., and McQuaid, K. (2019). Caring for the future: Climate change and intergenerational responsibility in China and the UK. *Geoforum*, 105:158–167.

Doerwald, F., Zacher, H., van Yperen, N., and Scheibe, S. (2021). Generativity at work: A meta-analysis. *Journal of vocational behavior*, 125:103521.

Downey, H., Threlkeld, G., and Warburton, J. (2016). How do older Australian farming couples construct generativity across the life course?: A narrative exploration. *Journal of aging studies*, 38:57–69.

Drews, S. (2025). Towards systems-oriented behavioral ecological economics. *Ecological economics*, 227:108402.

Erikson, E. (1963). *Childhood and society*. Norton, New York, second edition.

Essiz, O. and Mandrik, C. (2022). Intergenerational influence on sustainable consumer attitudes and behaviors: Roles of family communication and peer influence in environmental consumer socialization. *Psychology and marketing*, 39:5–26.

Evans, J. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annual review of psychology*, 59:255–278.

Evans, J. and Stanovich, K. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on psychological science*, 8:223–241.

Farrukh, M., Ansari, N., Raza, A., Wu, Y., and Wang, H. (2022). Fostering employee's pro-environmental behavior through green transformational leadership, green human resource management, and environmental knowledge. *Technological forecasting and social change*, 179:121643.

Fischer, M., Irlenbusch, B., and Sadrieh, A. (2004). An intergenerational common pool resource experiment. *Journal of environmental economics and management*, 48:811–836.

Fleurbaey, M. (2015). On sustainability and social welfare. *Journal of environmental economics and management*, 71:34–53.

Fornwagner, H. and Hauser, O. (2022). Climate action for my children. *Environmental resource economics*, 81:95–130.

Galleli, B. and Amaral, L. (2025). Bridging institutional theory and social and environmental efforts in management: A review and research agenda. *Journal of management*, 0:0.

Gronchi, G. and Giovannelli, F. (2018). Dual process theory of thought and default mode network: A possible neural foundation of fast thinking. *Frontiers in psychology*, 9:1237.

Grossbaum, M. and Bates, G. (2002). Correlates of psychological well-being at midlife: The role of generativity, agency and communion, and narrative themes. *International journal of behavioral development*, 26:120–127.

Grüner, B. and Konzett, S. (2024). Engagement of new entrants in mountain farming through the lens of generativity: Lack of family farming background and its implications in Alpine Austria and Italy. *Sociologia ruralis*, 64:325–352.

Guida, V., Klaser, K., and Mittone, L. (2025). Building sustainable futures through soft institutional interventions in the climate change context: An intergenerational experiment. *Futures*, 166:103531.

Guizar, R., Baumgartner, T., and Knoch, D. (2022). Interindividual differences in intergenerational sustainable behavior are associated with cortical thickness of the dorsomedial and dorsolateral prefrontal cortex. *NeuroImage*, 264:119664.

Halali, E. and Perez, O. (2025). Binding the future boosts intergenerational sustainability. *npj Climate Action*, 4:15.

Hara, K., Kitakaji, Y., Sugino, H., Yoshioka, R., Takeda, H., Hizen, Y., and Saijo, T. (2021). Effects of experiencing the role of imaginary future generations in decision-making: a case study of participatory deliberation in a Japanese town. *Sustainability science*, 16:1001–1016.

Hara, K., Nomaguchi, Y., Fukutomi, S., Kuroda, M., Fujita, K., Kawai, Y., Fujita, M., and Kobashi, T. (2023). Policy design by "imaginary future generations" with systems thinking : A practice by Kyoto city towards decarbonization in 2050. *Futures*, 154:103272.

Hara, K., Yoshioka, R., Kuroda, M., Kurimoto, S., and Saijo, T. (2019). Reconciling intergenerational conflicts with imaginary future generations: Evidence from a participatory deliberation practice in a municipality in Japan. *Sustainability Science*, 14:1605–1619.

Hauser, O. (2025). Climate change, intergenerational fairness, and the promises and pitfalls of artificial intelligence. *Environmental resource economics*, 88:2689–2706.

Hauser, O., Rand, D., Peysakhovich, A., and Nowak, M. (2014). Cooperating with the future. *Nature*, 511:220–223.

Hirose, J. (2024). How do question-answer exchanges among generations matter for children's happiness? *PLoS ONE*, 19:e0303523.

Hirose, J. (2025). Inquisitiveness, generativity, and subjective well-being in relation to intergenerational skills and knowledge: Evidence from a rural Japanese community. *Discover education*, 4:376.

Hirose, J. and Kotani, K. (2022). How does inquisitiveness matter for generativity and happiness? *PLoS ONE*, 17:e0264222.

Hirose, J., Kotani, K., and Managi, S. (2023). Do autonomy and inquisitiveness contribute to SDGs? Implications from the matrilineal island of Palau. *Economic analysis and policy*, 79:303–318.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. SAGE Publications.

House, R., Hanges, P., Javidan, M., Dorfman, P., and Gupta, V. (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. SAGE Publications.

Hu, S., Zheng, X., Zhang, N., and Zhu, J. (2018). The impact of mortality salience on intergenerational altruism and the perceived importance of sustainable development goals. *Frontier in psychology*, 9:1399.

Huang, C., Liu, H., Lin, T., and Lai, J. (2022). Revisiting Hofstede's dimensions of national culture and environmental sustainability. *Energy and environment*, 35:1251–1269.

Hüfner, K. (2000). UNESCO–United Nations Educational, Scientific and Cultural Organization. In *A concise encyclopedia of the United Nations*, pages 557–560. Brill Nijhoff.

Inoue, Y., Mifune, N., and Saijo, T. (2023). Positive reputation for altruism toward future generations regardless of the cost for current others. *Frontiers in psychology*, 13:895619.

Ioannou, I. and Serafeim, G. (2012). What drives corporate social performance? the role of nation-level institutions. *Journal of international business studies*, 43:834–864.

Jiang, W., Wang, X., and Du, L. (2023). Intergenerational externalities and corporate green innovation. *Sustainable development*, 31:2212–2221.

Jingchao, Z., Kotani, K., and Saijo, T. (2021). Are societies becoming proself? A topographical difference under fast urbanization in China. *Environment, development and sustainability*, 23:12976–12993.

Jones, B. and McAdams, D. (2013). Becoming generative: Socializing influences recalled in life stories in late midlife. *Journal of adult development*, 20:158–172.

Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.

Kamijo, Y., Komiya, A., Mifune, N., and Saijo, T. (2017). Negotiating with the future: Incorporating imaginary future generations into negotiations. *Sustainability science*, 12:409–420.

Katsuki, S. and Hizen, Y. (2020). Does voting solve the intergenerational sustainability dilemma? *Sustainability*, 12:6311.

Kaufmann, D. and Kraay, A. (2024). The worldwide governance indicators: Methodology and 2024 update. Technical Report WPS10952, World Bank Group.

Keyes, C. and Ryff, C. (1998). Generativity in adult lives: Social structural contours and quality of life consequences. In *Generativity and adult development: How and why we care for the next generation*, pages 227–263. American Psychological Association.

Kobayashi, K. and Chiba, A. (2020). Intergenerational bubbles of beliefs for sustainability. *Sustainability*, 12:10652.

Koirala, P., Timilsina, R., and Kotani, K. (2021). Deliberative forms of democracy and intergenerational sustainability dilemma. *Sustainability*, 13:7377.

Komp-Leukkunen, K. and Sarasma, J. (2024). Social sustainability in aging populations: A systematic literature review. *The gerontologist*, 64:1–12.

Law, K., Colaizzi, G., and Syropoulos, S. (2025). Climate change is an intergenerational challenge that requires intergenerationally focused behavioral solutions. *Current opinion in behavioral sciences*, 61:101467.

Leiß, G. and Zehrer, A. (2018). Intergenerational communication in family firm succession. *Journal of family business management*, 8:75–90.

Li, X., Mohd, N., Mohd, Y., Adeline, A., Zhang, J., Shi, Q., and Wang, Z. (2024). The impact of intergenerational transmission of cultural capital on holiday loyalty. *The social science journal*, pages 1–18.

Loewenstein, G. and Chater, N. (2017). Putting nudges in perspective. *Behavioural public policy*, 1:26–53.

Lohse, J. and Waichman, I. (2020). The effects of contemporaneous peer punishment on cooperation with the future. *Nature communications*, 11:1815.

Marteau, T., Hollands, G., and Fletcher, P. (2012). Changing human behavior to prevent disease: The importance of targeting automatic processes. *Science*, 337:1492–1495.

Mavrommati, G., Rogers, S., Howarth, R., and Borsuk, M. (2020). Representing future generations in the deliberative valuation of ecosystem services. *Elementa: science of the anthropocene*, 8:22.

McAdams, D. and Aubin, E. (1992). A theory of generativity and its assessment. *Journal of personality and social psychology*, 62:1003–1015.

Millová, K. and Blatný, M. (2018). Objective and subjective work characteristics and their relation to the successful development of adults in a society after a macrosocial transition. *Studia paedagogica*, 23:59–75.

Mishra, M., Desul, S., Santos, C., Mishra, S., Kamal, A., Goswami, S., Kalumba, A., Biswal, R., Silva, R., Santos, C., and Baral, K. (2024). A bibliometric analysis of sustainable development goals (SDGs): A review of progress, challenges, and opportunities. *Environment, development and sustainability*, 26:11101–11143.

Miska, C., Szőcs, I., and Schiffinger, M. (2018). Culture's effects on corporate sustainability practices: A multi-domain and multi-level view. *Journal of world business*, 53:263–279.

Miyake, K., Hizen, Y., and Saijo, T. (2023). Proxy voting for future generations: A laboratory experiment using the general public. *Sustainability*, 15:14310.

Moldavanova, A. (2016). Two narratives of intergenerational sustainability: A framework for sustainable thinking. *American review of public administration*, 46:526–545.

Mostafizur, R., Asma, K., Islam, M., Saijo, T., and Kotani, K. (2025). Does future design induce people to make a persistent change to sustainable food consumption? *Food policy*, 135:102916.

Mullainathan, S. and Shafir, E. (2013). *Scarcity: Why having too little means so much*. Macmillan.

Naciti, V., Cesaroni, F., and Pulejo, L. (2022). Corporate governance and sustainability: A review of the existing literature. *Journal of management and governance*, 26:55–74.

Nakagawa, Y. (2020). Taking a future generation's perspective as a facilitator of insight problem-solving: Sustainable water supply management. *Sustainability*, 12:1000.

Nakagawa, Y., Arai, R., Kotani, K., Nagano, M., and Saijo, T. (2019a). Intergenerational retrospective viewpoint promotes financially sustainable attitude. *Futures*, 114:102454.

Nakagawa, Y., Kotani, K., Matsumoto, M., and Saijo, T. (2019b). Intergenerational retrospective viewpoints and individual policy preferences for future: A deliberative experiment for forest management. *Futures*, 105:40–53.

Nakagawa, Y. and Saijo, T. (2020a). Can individuals caring little about future generations serve as their representatives? *Futures*, 124:102626.

Nakagawa, Y. and Saijo, T. (2020b). Future design as a metacognitive intervention for presentism. *Sustainability*, 12:7552.

Nakagawa, Y. and Saijo, T. (2021). A visual narrative for taking future generations' perspectives. *Sustainability science*, 16:983–1000.

Nakawake, Y. and Kobayashi, Y. (2024). Exploring new technologies for the future generation: Exploration–exploitation trade-off in an intergenerational framework. *Royal society open science*, 11:231108.

North, D. (1990). *Institutions, institutional change and economic performance*. Political Economy of Institutions and Decisions. Cambridge university press, Cambridge.

Oliveira, R. (2018). Back to the future: The potential of intergenerational justice for the achievement of the sustainable development goals. *Sustainability*, 10:427.

Oliveira, R. (2023). Irreplaceable goods: Bridging sustainability and intergenerational sufficientarianism. *Ethics, policy and environment*, 26:438–454.

Ordonez-Ponce, E. (2023). The role of local cultural factors in the achievement of the sustainable development goals. *Sustainable development*, 31:1122–1134.

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, 325:419–422.

Page, M., McKenzie, J., Bossuyt, P., Boutron, I., Hoffmann, T., Mulrow, C., Shamseer, L., Tetzlaff, J., Akl, E., Brennan, S., Chou, R., Glanville, J., Grimshaw, J., Hróbjartsson, A., Lalu, M., Li, T., Loder, E., Mayo-Wilson, E., McDonald, S., McGuinness, L., Stewart, L., Thomas, J., Tricco, A., Welch, V., Whiting, P., and Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372:n71.

Panayotou, T. (1997). Demystifying the environmental Kuznets curve: Turning a black box into a policy tool. *Environment and development economics*, 2:465–484.

Pandit, A., Nakagawa, Y., Timilsina, R., Kotani, K., and Saijo, T. (2021). Taking the perspectives of future generations as an effective method for achieving sustainable waste management. *Sustainable production and consumption*, 27:1526–1536.

Park, H., Russell, C., and Lee, J. (2007). National culture and environmental sustainability: A cross-national analysis. *Journal of economics and finance*, 31:104–121.

Perez-Encinas, A., De, P., Bueno, Y., and Santos, B. (2021). Intergenerational entrepreneurship to poster sustainable development: A methodological training proposal. *Sustainability*, 13:9654.

Rose, M. (2024a). Can we represent future generations in myopic democracies? – Analyzing the design, feasibility and viability of institutional guardians of future generations. *Policy studies*, pages 1–21.

Rose, M. (2024b). Institutional proxy representatives of future generations: A comparative analysis of types and design features. *Politics and governance*, 12:7745.

Roy, S. and Ayalon, L. (2024). "They did not know what they were doing": Climate change and intergenerational compassion. *The gerontologist*, 64:1–9.

Saijo, T. (2020). Future design: Bequeathing sustainable natural environments and sustainable societies to future generations. *Sustainability*, 12:6467.

Saijo, T. (2024). Futurability, survivability, and the non-steady state in the intergenerational sustainability dilemma. *Politics and governance*, 12:7749.

Sedita, S., Blasi, S., and Yang, J. (2022). The cultural dimensions of sustainable development: A cross-country configurational analysis. *Sustainable development*, 30:1838–1849.

Shahen, M., Kotani, K., and Saijo, T. (2021). Intergenerational sustainability is enhanced by taking the perspective of future generations. *Scientific reports*, 11:2437.

Shahen, M., Masaya, W., Kotani, K., and Saijo, T. (2020). Motivational factors in intergenerational sustainability dilemma: A post-interview analysis. *Sustainability*, 12:7078.

Shahen, M., Shahrier, S., and Kotani, K. (2019). Happiness, generativity and social preferences in a developing country: A possibility of future design. *Sustainability*, 11:5256.

Shahrier, S., Kotani, K., and Saijo, T. (2017). Intergenerational sustainability dilemma and the degree of capitalism in societies: a field experiment. *Sustainability science*, 12:957–967.

Sharafuddin, M. and Madhavan, M. (2020). Thematic evolution of blue tourism: A scientometric analysis and systematic review. *Global business review*, 25:533–554.

Spijkers, O. (2018). Intergenerational equity and the sustainable development goals. *Sustainability*, 10:3836.

Stanes, E., Klocker, N., and Gibson, C. (2015). Young adult households and domestic sustainabilities. *Geoforum*, 65:46–58.

Summers, J. and Smith, L. (2014). The role of social and intergenerational equity in making changes in human well-being sustainable. *Ambio*, 43:718–728.

Sunstein, C. (2015). The ethics of nudging. *Yale journal on regulation*, 32:413–450.

Sweileh, W. (2020). Bibliometric analysis of scientific publications on "sustainable development goals" with emphasis on "good health and well-being" goal (2015–2019). *Global health*, 16:68.

Syropoulos, S., Law, K., and Young, L. (2023). National differences in age and future-oriented indicators relate to environmental performance. *Sustainability*, 16:276.

Teodoro, J., Doorn, N., Kwakkel, J., and Comes, T. (2023). Flexibility for intergenerational justice in climate resilience decision-making: An application on sea-level rise in the Netherlands. *Sustainability science*, 18:1355–1365.

Thaler, R. and Sunstein, C. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press.

Timilsina, R., Kotani, K., and Kamijo, Y. (2019). Generativity and social value orientation between rural and urban societies in a developing country. *Futures*, 105:124–132.

Timilsina, R., Kotani, K., Nakagawa, Y., and Saijo, T. (2021). Concerns for future generations in societies: A deliberative analysis of the intergenerational sustainability dilemma. *Journal of behavioral and experimental economics*, 90:101628.

Timilsina, R., Kotani, K., Nakagawa, Y., and Saijo, T. (2022). Intragenerational deliberation and intergenerational sustainability dilemma. *European journal of political economy*, 73:102131.

Timilsina, R., Kotani, K., Nakagawa, Y., and Saijo, T. (2023). Does being intergenerationally accountable resolve the intergenerational sustainability dilemma? *Land economics*, 99:644–667.

Timilsina, R., Nakagawa, Y., and Kotani, K. (2020). Exploring the possibility of linking and incorporating future design in backcasting and scenario planning. *Sustainability*, 12:9907.

Tonn, B. (2018). Philosophical, institutional, and decision making frameworks for meeting obligations to future generations. *Futures*, 95:44–57.

Triandis, H. (1995). *Individualism and collectivism*. Routledge.

Tse, W. (2024). Intergenerational knowledge sharing in sustainable tourism: Social learning theory perspective. *Asia pacific journal of tourism research*, 29:1369–1381.

Urien, B. and Kilbourne, W. (2011). Generativity and self-enhancement values in eco-friendly behavioral intentions and environmentally responsible consumption behavior. *Psychology and marketing*, 28:69–90.

van Gestel, L., Adriaanse, M., and de Ridder, D. (2021). Motivated by default: How nudges facilitate people to act in line with their motivation. *Motivation science*, 7:319–330.

Vatansever, D., Menon, D., and Stamatakis, E. (2017). Default mode contributions to automated information processing. *Proceedings of the national academy of sciences of the United States of America*, 114:12821–12826.

Wang, J., Su, M., Wall, G., Dong, H., and Zhang, H. (2024). Intergenerational evolution of intangible cultural heritage through tourism development: Perspectives of practitioners in Hangzhou China. *International journal of heritage studies*, 30:968–991.

Whear, R., Campbell, F., Rogers, M., Sutton, A., Robinson-Carter, E., Sharpe, R., Cohen, S., Fergy, R., Garside, R., Kneale, D., Melendez-Torres, G., and Thompson-Coon, J. (2023). What is the effect of intergenerational activities on the wellbeing and mental health of older people?: A systematic review. *Campbell systematic reviews*, 19:e1355.

Wu, J., Zhang, L., and Ren, X. (2022). Incorporating the co-creation method into social innovation design to promote intergenerational integration: A case study of a public square. *International journal of environmental research and public health*, 19:12908.

Yamaguchi, N., Bernardino, E., Ferreira, M., Lima, B., Pascotini, M., and Yamaguchi, M. (2023). Sustainable development goals: A bibliometric analysis of literature reviews. *Environmental science and pollution research*, 30:5502–5515.

Yamane, T. and Kaneko, S. (2021). Is the younger generation a driving force toward achieving the sustainable development goals? survey experiments. *Journal of cleaner production*, 292:125932.

Zhang, M. (2018). Intergenerational justice and solidarity on sustainability in China: A case study in Nanjing, Yangtze River Delta. *Sustainability*, 10:4296.