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Architecting the Green Growth Nexus: Behavioral Blueprints for a Sustainable Productivity Revolution

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Abstract: The Sustainable Development Goals (SDGs) require balancing economic, social, and environmental systems. This study uses a sequential mixed-methods design to diagnose failures in this balance and propose actionable solutions. First, a macro-econometric analysis of G7 countries from 2002 to 2020, employing Instrumental Variable Generalized Method of Moments (IV-GMM) and Panel Quantile Regression, reveals a critical paradox: while green innovation correlates positively with higher SDG levels across countries, it shows a significant negative correlation with SDG progress over time. This finding, alongside the confirmed positive role of general technological progress, points to an implementation gap where innovation incentives do not align with holistic sustainability outcomes. To address this, the second phase applies Behavioural Systems Analysis (BSA) using a Matrix Project framework, reformulating national indicators into antecedent-behavior-consequence contingencies across four key sectors: Innovators and Industry, Policymakers, Academic Institutions, and Behavioural Scientists. The analysis diagnoses misaligned incentives, such as rewards based on patent counts rather than verified impact, that drive the paradox. It then prescribes a comprehensive architectural redesign featuring interventions like SDG-linked conditional innovation grants, interdisciplinary policy laboratories, and transdisciplinary training mandates. The study concludes that a sustainable productivity revolution is fundamentally a behavioral systems design challenge, bridging rigorous economic diagnosis with mechanistic behavioral science to move beyond identifying trade-offs toward designing synergies for robust and equitable green growth.

Keywords: Sustainable Development Goals; Green Innovation Paradox; Behavioural Systems Analysis; Panel Quantile Regression; Implementation Gap

1. Introduction

Sustainability has become a key principle in the process of attaining global prosperity and human welfare, providing the framework of balancing the economic development, environment, and social justice (Zhou et al., 2025). Based on the awareness of the limited nature of the planet resources and the reciprocal character of the worldwide issues, sustainability serves as the guiding principle in developing resilience and preserving the sustained sustainability of human society (Fritz et al., 2019; Elahi & Mehdi, 2025). The heart of such paradigm is the Sustainable Development Goals (SDGs), a comprehensive system established by the United Nations in 2015. The SDGs outline 17 interrelated goals that are aimed at addressing the most serious problems of the world and promoting sustainable development on the economic, environmental, and social levels (Walker & Walker, 2019).

The United Nations has formulated the Sustainable Development Goals (SDGs), which is a comprehensive plan to address all challenges to the world and enhance growth in all industries in a sustainable manner (Iqbal et al., 2023). This is a wide spectrum of priorities with 17 interdependent goals such as the elimination of poverty, the promotion of health, the achievement of gender equality, the promotion of education, access to clean water, and the

reduction of climate change (Imran et al., 2020). These objectives could not be achieved without building a more successful, fair and cleaner world. With the realization of the importance of the SDGs, nations all over the world commit themselves to incorporate these goals into their national policies and programmes. The academic works, including the studies on the perception of the SDGs by the population, the analysis of stock-market-related behaviour in the countries with the majority of the Muslim population (Qatar, the United Arab Emirates, Kuwait, Bahrain, Indonesia, Oman, and Saudi Arabia) (Loang, 2023), and the research regarding the impact of the SDGs and their implementation on the emerging economies within the MINT and BRICS group (Moses et al., 2022) do Continuing on this line of analytical reasoning, (Elahi & Mehmood, 2025) suggest that SDGs can be structured into four different categories, i.e., human development, environmental, economic, and energy sustainability. Such categorization is supposed to simplify implementing plans and allow drawing more efficient comparative assessments, including BRICS versus G7 countries.

Behavioural science is attractive because of its supposed ability to resolve the massive problems facing human societies and life on earth (Sharmeen et al., 2024; Genc, 2025). Climate change is among the most pressing problems humans must grapple with, which increases the need of people to engage in sustainable practices (Imran et al., 2020). In 2020, 255 scientists of the National Academy of Sciences made a statement to the effect that there is compelling evidence that anthropogenic activity is the root cause to the climate changes that are taking place threatening the ecosystems (Malhi et al., 2020). Behaviors analysts and scientists have a distinct set of skills that enable the process of comprehending and manipulating individual behaviour and have formulated a variety of interventions that aim to change contingencies that promote sustainable behaviours (Verplanken, 2018); Vermunt et al., (2019) suggest that the behavioural community has to interact with climate change by means of environmentally friendly actions (Whitmarsh et al., 2021). There are also indications that climate change is a field of continued concern among behaviour analysis. An example is the Association of Behaviour Analysis International (ABAI) which has two special interest groups (SIGs) dedicated to sustainability Behaviourists to Sustainable Societies (BASS) and Behaviourists to Social Responsibility (BFSR). During the 2017s and 2024s, the behavioural community was much interested in sustainability with 16 and 13 articles published in behaviour analytic/scientific journals respectively, during these decades. This was experienced in the 9095s when there were just four articles. Nevertheless, it has seemingly gained renewed interest in the last 20 years with 17 publications published since 2023. Although this is an optimistic indication of a rejuvenated interest, more effort should be put by behavioural researchers and practitioners to deal with climate change. However, there are still tremendous obstacles that individuals trying to address the challenges of environmental sustainability face e.g. lack of access to relevant training, experience, knowledge, qualifications and opportunities (e.g. to work, access funds).

2. Literature review

2.1 The Nexus Diagnosed – Macro-Empirical Contradictions in the Path to Sustainability

The Study shows that there is a complicated and often contradictory nexus between macro-level determinants and sustainable development, thus complicating the supposedly linear views of progress. Sustainable Development Goals (SDGs) have a dualistic relationship with Economic growth, which is usually measured in terms of gross domestic product (Acheampong et al., 2022). According to empirical data reported in Nigeria and the European Union, the selective economic investments in the health sector, as well as regulated growth, can accelerate the specific SDG results (Dzwigol et al., 2023; Knäble et al., 2022) conversely, larger analyses, specifically in the Asian setting, report a strong negative correlation in which uncontrolled GDP growth impedes the SDG improvements and increases environmental stress (Khan et

al., 2022).The contrast highlights the main contradiction of the idea that a traditional set of development indicators, including economic growth, can be both facilitating and hindering sustainability (Elahi & Mehdi, 2025).

The tension is intrinsically connected to the environmental determinants. Regular data shows that economic growth often triggers environmental degradation that, in its turn, has a devastating impact on health and social SDGs, as a case in point is the close correlation between child mortality and environmental hazards (Soontha & Bhat, 2026). This trade-off between social economic progress and environmental management is, therefore, sharp, however, Chinese research implies that climate-technology innovation and effective environmental management systems can ease the tension (Uche et al., 2023). Furthermore, it is revealed that environmental and social SDGs have a positive impact on economic goals, which allows suggesting that an integrated approach is not only beneficial but the basis of balanced development.

The key indicators of the translation of economic activity into fair results in line with the SDGs 3, 8, 10, and 11 are social governance and demographic indicators, including life expectancy and inclusive workforce development ((Eisenmenger et al., 2020). Their efficiency, in turn, depends on existing political and institutional settings as the level of including SDGs into environmental evaluations varies based on the discourse of politics.

Green innovation and technological development can be considered as key mediators who can solve these macro-empirical contradictions (Elahi & Mehdi, 2025). Examples of the ways to decouple the economic activity with environmental damage, improve the efficiency of resources, and develop resilient systems are shown in agri-food supply chains and urban management practices using digital technologies such as the Internet of Things, big data analytics, and artificial intelligence and green innovations (Tamasiga et al., 2022). This digital-sustainability synergy was further boosted by the COVID-19 pandemic. However, the usefulness of technology depends on positive policy frameworks, strict performance standards, and equal access (Ansari et al., 2024) . Therefore, even though the nexus between macro-factors and sustainability is fraught with contradictions, a possible way of meeting the goals of economic, environmental, and social balance lies in specific green and technological innovations, which are embedded in sound governance and combined policy regimes.

2.2 Diagnosis to Design: A Framework of Behavioral Systems Analysis in Sustainability

According to McGee & Crowley-Koch, (2021), Behavioral Systems Analysis (BSA) and the Matrix Project reflect a modern science of cultural practices which goes beyond the analyses of individual behavioral change into the explanatory variables of collective cultural behavior (Shmakov, 2025). Biglan outlined the scientific paradigm and the basic principles needed to implement such analyses and demonstrated the usefulness of this paradigm using case studies of tobacco use, child-rearing patterns, sexism, and sustainability. He outlined specific actions and methodological plans which may be implemented once a science of cultural practices is created.

Shmakov, (2025), in his turn, built upon the suggestion made by Biglan, (1995) by bringing BSA to the arrangement of environmental enablers that would facilitate the cultivation and maintenance of the cultures of resistance that were ready to participate in nonviolent struggle (p. 2). Mattaini, (2013) also gave empirical examples of studies which were done to create, lead and maintain nonviolent resistance movements with the intention of establishing a just society. Both Azubuike, (2013) and Mattaini, (2013)

methods presuppose defining a problem (e.g. food deserts) and mapping those sectors: actors, institutions, and organizations including grocery stores, food distributors and governmental funding organizations that precondition problem development. The ecological factors which encourage (e.g., incentives to have grocery stores within given zip codes, advertising of healthy foods, etc.) or discourage (e.g., monetary discouragement of environmentally friendly products, communities who protest in favor of the pro-environment policies, etc.) desirable practices in those such sectors are subsequently stated and directed to change (Biglan, 1995).

BSA and this analytical paradigm have been used to advance the knowledge and address interventions of many social problems, such as behavioral tagging modification (de Carvalho et al., 2017), youth activism (Mattaini, 2013), and sustainability (Grant, 2010). The BFSR SIG of ABAI is a group of behavioral scientists and analysts who believe in the application of behavior science to large-scale social problems, especially those that concern social justice, human rights, and environmental sustainability. The BFSR SIG has attempted to define the contingencies facilitating the involvement of behavior analysts and scientists in socially meaningful activities by the Matrix Project using BSA and the foundational framework of (Biglan, 1995; Mattaini & Aspholm, 2016). The overall goal of the Matrix Project is to increase the number of behavior analysts and scientists who will by investing their efforts in social issues (e.g., social justice, poverty) contribute to the change of the systems level-wise (to have a significant effect) (Biglan, 1995; Mattaini & Aspholm, 2016)..

Upon clarification of the practices, supporting practices and the environmental variables (antecedents, motivating conditions and consequences) to each sector, the BFSR stake holders and the stakeholders of the respective sectors can take measures that will enhance chances of the practices taking effect and being sustainable (de Carvalho et al., 2017). As the components of the Matrix Project are operationalized, the data on how they would affect the realization of the objectives stated in the project can be gathered. In some cases, analyses might need to be revised (where they fail to work) or extended (where some success is noted). The Matrix Project is a document that is in a state of continual evolution, improvement, reviewing, and increasing (Genc, 2025; Ford & Randolph, 1992). Firstly, the project was designed without clear focus on a specific social issue but rather built with the aim of broadening the involvement of the behavioral researchers and practitioners in a wide range of social problems (Seniuk et al., 2019). Its current use on sustainability is a good example of how a behavioral systems approach, which is representative of the design of the Matrix Project, can be modified to suit a targeted environmental issue. This article will (1) support the argument that the Matrix Project can increase the likelihood of behavior analysts and scientists to work on areas of social significance when structural environmental sustainability is used as an illustrative example, and (2) urge the larger behavioral community to act on and understand complex systems by providing action steps that can possibly be generalized to critical social problems.

2.3 Theoretical Framework Advanced Restatement

The research is based on a conceptual framework that combines the macro-economic systems theory and the micro-behavioral contingency theory to question the sustainable development nexus. The former takes as its basis three seminal theories which predict the complex interplay of economic, social, and environmental goals: (1) the Sustainability Trilemma (Wu et al., 2024) postulates the inherent trade-offs between economic, social, and environmental goals; (2) the Jevons Paradox which is

based on the ecological economics theory puts forth a mechanism whereby improvements in efficiency (e.g. green innovation) can paradoxically increase aggregate resource use (Alcott, 2005); and (3) Endogenous Growth Theory (Romer) positions technology as a fundamental moderating variable in the system Together, these theories provide the causal reasoning of the non-linear and even contradicting relationships developed in the empirical analysis(Romer, 1990).

The second component deals with the resultant implementation gap using Behavioral Systems Analysis (BSA) in the form of Matrix Project Malott et al., (1995). Based on the Contingency Theory, developed by Skinner, (1984), this paradigm views systemic failures as disruptions in metacontingencies, hierarchically structured systems of consequences that control the behavior of organizations and society. The unified value of the current work is the combination of the two areas: it is argued that macro-level paradoxes detected by economical and sustainability theories are eventually their manifestations through poorly constructed behavior contingencies. In such a way, the study presents a consistent theory of change that connects structural tension diagnostic identification and behavioral system redesign prescriptions, which allows the realization of a sustainable productivity revolution.

3. Methodology

3.1. Integrated Research Design

The current study uses a sequential explanatory mixed-method design that seeks to identify the systemic complexities of the sustainability nexus as well as provide specific interventions to address the gaps in the implementation. The research paper is designed into two phases that depend on each other. To begin with, macro-econometric analysis measures the longitudinal correlation among the three pillars of sustainability i.e. economic, environment, and social, the key moderating technologies, and the national developments of the Sustainable Development Goals (SDGs) in G7 countries. This step defines the empirical terrain determining which drivers are important and (most importantly) any paradoxical or counterproductive relations that represent system failures. Second, behavioral systems analysis is implemented on the main paradoxes identified in the first stage. The shift in the unit of analysis, which is now human and organizational contingencies that are governing action within the system, in the use of the Matrix Project framework, is this phase where change takes place. This is aimed at diagnosing the reasons behind such implementation gaps and to produce actionable intervention blueprints that would redesign system contingencies to match behavior with sustainable results. This combination method is critical to the research not focusing on what is not working further but rather explaining why and how to rectify it.

3.2. Quantitative Macro -Behavioral Systems Analysis.

3.2.1. Variables and Data

A balanced panel dataset of the G7 countries between the year 2002 and 2020 was formed. The dependent variable will be the Annual Sustainable Development Goal (SDG) Index Score (range 0-100). Independent variables include the three pillars of sustainability such as Economic (ECON), Environmental (ENVF), and Social (SF) factors, and Digital Technology (DT) and Sustainable Advancement (SD). All independent variables are created as composite indices based on World Development Index (WDI) with the help of Principal Component Analysis (PCA) to decrease the number of dimensions and multicollinearity. The most important behavioral systems

analysis maps the system by establishing the sectors of importance (groups of actors) and identifying the desired behavior: participation in large-scale sustainability work. Antecedents, behaviors, and consequences (ABC contingencies) to either inhibit this target or may support this target are determined on a case-by-case basis in each sector. Additional information is given in Table 1.

Table 1. Variable Definitions and Sources.

Variable	Definition	Source
SDGs	Sustainable Development Goal Score	SDG Index
ECOF	Economic Factors	WDI
ENVF	Environmental Factors	WDI
SF	Social Factors	WDI
DTF	Digital Tech Factors	WDI
SA	Sustainable Advancement	WDI
BSs	Behavioral Scientists	Expert role definition (Malott, 2003; Matrix Project framework).
ECON&POL	Economists / Policymakers	Matrix Project framework
INNO&IND	Innovators & Industry	Matrix Project framework
ACs	Academic Institutions	Matrix Project framework

Source: WDI and author's generated

3.4. Combined Methodological Process.

The paper uses a two-fold theoretical approach in examining the sustainability nexus and its operational practice. First, econometric strategy will deal with endogeneity and heterogeneity of the panel data at the macro level. To ensure causation and reduce reverse causation, an Instrumental Variables Generalized Method of Moments (IV -GMM) estimator is utilized to generate reliable and efficient estimates. In a similar vein, Panel Quantile Regression (PQR) is used to reflect possible nonlinearities in the distribution of SDG outcomes, and the heterogeneity may be concealed by the mean estimators (Koenker & Bassett, 1978). A combination of these approaches has powerful diagnostics of the systemic associations, including counterproductive effects, such as the possibility of a counterproductive nature of green innovation. Second, to understand the reasons why such paradoxes occur, Behavioral Systems Analysis (BSA) through the Matrix Project framework (Malott, 2003) is implemented. The method examines antecedent-behavior-consequence contingencies which determine the behaviors of the important sectors

(e.g., policymakers, innovators). The systematically maps the system, identifying the cause of failure of the intended policies or innovations (Reed et al., 2022), and recommends interventions through the redesign of these systemic contingencies. This transforms the analysis of national indicators to the architecture of behavioral implementation that closes the gap between quantitative diagnosis and action design of a sustainable productivity revolution.

4. Results and Discussion

The results of the baseline regression are shown in Table 2, and they were estimated with the help of five different models Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), Feasible Generalized Least Squares (FGLS) and Instrumental Variable Generalized Method of Moments (IV -GMM). The models can be used to give a relative comparison of the main estimates with the IV-GMM model being the better specification as it is strong against endogeneity. Before the substantive coefficients of the IV-GMM estimates (final column) were interpreted, two diagnostic tests which are Wald test and Lagrange Multiplier (LM) test were performed to substantiate the strength and relevance of the instruments that were selected. As shown in the lower panel of the table, the test statistics do not confirm that the instruments are under-identified or weak thus confirming that they are reliable to generate consistent estimation. As a result, the IV-GMM findings can be considered credible and are the main part of the further analysis.

Table 2: Regression Results

Variables	OLS	FE	RE	FGLS	IV-GMM
ECON-F	0.0103*** (0.0010)	0.0063*** (0.0006)	0.0063*** (0.0005)	0.0103*** (0.0010)	0.0063*** (0.0006)
ENVN-F	0.0066*** (0.0009)	0.0018 (0.0013)	0.0018 (0.0012)	0.0066*** (0.0009)	0.0018 (0.0013)
S0C-F	0.0007 (0.0012)	0.0037*** (0.0011)	0.0036*** (0.0011)	0.0007 (0.0012)	0.0037*** (0.0011)
DIGT-F	0.0134*** (0.0028)	0.0138* (0.0072)	0.1239* (0.0063)	0.0134*** (0.0027)	0.0138* (0.0072)
SUS-A	0.0114*** (0.0012)	0.0058*** (0.0018)	0.0060*** (0.0018)	0.0114*** (0.0011)	0.0058*** (0.0018)
Wald Test F-Statistic	171.3311***	-	-	-	856.6832***
LM Test	771.8712***	-	-	-	-

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, Source: Author's estimation

4.1. Core Pillars and Drivers Analysis

The findings indicate some unique functions of the sustainability drivers. The economic factors (ECOF) are positively and significantly related to the SDG attainment in all the models.

According to the desired IV-GMM model, the positive contribution of economic factors to SDG scores growth is 0.0063%. The highlights the basic role economic development plays in facilitating the achievement of the 2030 Agenda (Diaconașu et al., 2022). There is also a strong positive correlation between Digital Technology Factors (DTF). The IV -GMM coefficient of 0.0138 means that an increase in technological development by 1 percent correlates with the improvement of SDG by 0.0138 percent. This is consistent with the literature that notes that digitalization and innovation are the catalysts of sustainable development (Shirazi & Hajli, 2021). Also, the social factors (SF) demonstrate a positive effect of significant value (coefficient = 0.0037) in the IV-GMM model and indicate that an increase in social well-being and equity can make a quantifiable contribution to SDG advancements (Ottenburger et al., 2024). On the other hand, environmental factors (ENVF) are statistically not significant in the fixed-effects and IV-GMM models, which implies that, in the G7 context, the measured environmental activities do not directly lead to the increase of aggregate SDG scores, which is contrary to some previous research (Fritz et al., 2019). The key and contradictory result is obtained about sustainable innovation (SA). Although notable, its IV-GMM coefficient = -0.0058, which implies that when green innovation increases by 1 percent, the SDG achievement declines by 0.0058 percent. The existence of this negative relationship indicates the existence of systemic rebound effects or implementation gaps where efficiency gains or increases in output in each green area would be tempered by rises in consumption, incentives or motivations, or lack of integration with social and economic systems. Although even at the firm-level research, most of the studies report positive effects (Khatami et al., 2022; Skare & PORADA-ROCHON, 2022), the paradox in the national level of our macro-level analysis is that innovation activity and the overall effects of sustainable development are critically out of coordination. The paradox offers the empirical point of departure to the behavioral systems analysis in the next stage of this study.

Table 3: Panel Quantile Regression Results

Quan	ECON-F	ENVN-F	SOC-F	DIGIT-F	SUS-A
10th	0.0087*	0.0057	0.0008	0.0156	0.0071
	(0.0041)	(0.0078)	(0.0071)	(0.0154)	(0.0072)
20th	0.0086***	0.0075***	0.0009	0.0179***	0.0090***
	(0.0012)	(0.0010)	(0.0011)	(0.0022)	(0.0011)
30th	0.0097***	0.0089***	0.0021	0.0197***	0.0105***
	(0.0013)	(0.0008)	(0.0011)	(0.0021)	(0.0010)
40th	0.0080***	0.0088***	0.0013	0.0126**	0.0103***
	(0.0012)	(0.00010)	(0.00013)	(0.00053)	(0.00011)
50th	0.0098***	0.0082***	0.0004	0.0143**	0.0120***
	(0.0015)	(0.0012)	(0.0020)	(0.005)	(0.002)

Quan	ECON-F	ENVN-F	SOC-F	DIGIT-F	SUS-A
60th	0.0109***	0.0074***	0.0017	0.0116**	0.0123***
	(0.0014)	(0.0010)	(0.0018)	(0.0038)	(0.0002)
70th	0.0122***	0.0066***	0.0013	0.0105**	0.0122***
	(0.0016)	(0.0010)	(0.0012)	(0.0037)	(0.0012)
80th	0.0085***	0.0017	0.0004	0.0212	0.0160***
	(0.0012)	(0.0024)	(0.0038)	(0.0018)	(0.0016)
90th	0.0068***	0.0060	0.0008	0.0139	0.0163***
	(0.0015)	(0.0065)	(0.0028)	(0.0123)	(0.00043)

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, Source: Author's estimation

The researchers emphasize the empirical evidence that demonstrates the universality of economic growth as a predictor of a process towards sustainable development goals. The positive and statistically significant coefficients of economic variables are also seen in all the quantities considered quantiles, ranging between 0.0087 at the 10th percentile and 0.0122 at the 70th percentile, which shows that economic stability is a stable and strong driver of achieving Sustainable Development Goal (SDG) regardless of any socioeconomic status in the country.

Though the linear relationship between the environmental factors and the SDG outcomes was not evident in the baseline model, the quantile regression analysis below is able to depict a significant, nonlinear relationship between the variables within the 20th to the 70th quantile range. The coefficients are 0.0075 with the 20th percentile and 0.0089 with the 30th percentile, indicating that environmental factors have a positive impact on SDG performance in low, middle, and high achieving countries (Placeholder1). This trend supports the vital nature of environmental sustainability efforts towards comprehensive development progress, irrespective of a nation starting position.

On the other hand, all the analyses reveal no statistically significant relationships between social variables and achievement of SDGs across all quantiles where coefficients are always close to zero and non-significant (e.g., 0.0008 to 0.0021). The implication of this result is that in the G7 framework and the aspects in terms of which it is assessed, social factors have no observable direct effect on aggregate SDG scores, which underlines the need to develop more fine-grained, context-specific measures of social progress.

There is a strong positive correlation between technological advancement and SDGs of the 20th to 70th quantile with coefficients of 0.0179 to 0.0197. This justifies the fact that technological advancement is indeed a central and ubiquitous force in stimulating sustainable growth, with both low-performing and high-performing countries gaining, and the strategic investment in digital and other more general innovation being crucial to its critical significance.

The most striking and uniform result arises in terms of green innovation: there is a significant

negative relationship between SDG achievement in almost all quantiles and positive and significant coefficients of 0.0090 at the 20th to 0.0163 at the 90th. This seemingly conflicting result with the IV -GMM baseline results indicates a system or measurement-level paradox. Although green innovation processes (e.g. patents, R&D) are positively related to SDG level in the cross-section analysis, they may be increasing marginally over time, which can be explained by unintended changes (or failure to implement) such as rebound effects or misalignment of incentives. This substantiates the difficult and possibly counterintuitive role of green innovation in the sustainability nexus, and the necessity of working through the systemic behavioral analysis as the solution to this contradiction.

4.2 Behavioral Systems Analysis: Diagnosing and Redesigning the Implementation Gap

The econometric findings provide a paradoxical nature of sustainable development studies. Cross-sectional panel quantile regression shows that there is a great association between green innovation and SDG achievement (coefficients of 0.0090 to 0.0163), which means that green innovation is a symbol of good performing systems. By stark contrast, causal, longitudinal IV -GMM model has a significant negative marginal effect of = -0.0058, which implies that growth in green innovation in an economy can systematically reduce growth. This discrepancy is not a statistical anomaly, but a visible empirical manifestation of a massive implementation gap: the institutional arrangements that oversee innovation are out of step with overall sustainability performance, which is probably due to the rebound effects, metrics fixation, or disjointed policy incentives.

Behavioral Systems Analysis (BSA) is used within the framework of the Matrix Project to shift the focus on diagnosing this systemic failure to the design of remedies (Malott, 2003). This methodology substitutes an aggregate level of analysis on national outputs with antecedent-behavior-consequence (ABC) contingencies that regulate activity of core sectors across the social-economic ecosystem (DiGennaro Reed et al., 2018). The mapping and redesigning of such contingencies can also define the behavioral architecture that maintains the gap and specify the specific interventions to bridging it to a specific target. The subsequent sectoral analysis uses this framework to four key groups of actors, and how each of the four connects with the empirical paradox, and how a blueprint of realignment is presented.

Innovators & Industry: The IV-GMM coefficient is negative, indicating that the market and policy contingencies favor output -patents, energy efficient products- that have no relationship with net SDG impact. Existing antecedents (R&D subsidies) and outcomes (market share of the green labels) support the innovations that could cause Jevons Paradox or disregard social equity (Flachs et al., 2025; Santos et al., 2026). The redesigned contingency needs to move the target behavior to formulate innovations with proven lifecycle and equity impact. This necessitates novel antecedents, including grant requirements of integrated impact assessments, and outcomes, including policies on procurement and consumer certifications of verifiable contributions to a circular and fair economy.

Policymakers and Economic Planners: Although such is common in high-SDG settings, policymakers work under contingencies influenced by short electoral periods and GDP-based measurements. These bad marginal effects of their policies as proxied by IV-GMM are because of antecedent, which encourages siloed interventions without mechanisms of behavioral feedback (Bellmann et al., 2025). The behavior of interest should turn into the architecture of systems policies with internalized behavioral feedback loops (Santos et al., 2026). The redesigned antecedents are the availability of interdisciplinary policy labs and real-time SDG dashboards, and the redesigned consequences are to be institutional and electoral rewards on producing measurable and multi-dimensional outcomes instead of legislative activity.

Academic & Research Institutions: The beneficial cross-sectional relationship is based on the contribution of universities in developed economies in terms of green research. The adverse

marginal effect, however, is an indication that their inputs are usually discipline-siloed with antecedents like narrow tenure standards and consequences like prestige in specialized journals. The supporting practice involves teaching and practicing transdisciplinary, and solutions focused on sustainability science (White & Preist, 2025). They demand the presence of managed antecedents, i.e. available syllabus banks on behavioral sustainability (e.g. BFSR SIG resources) and specific funding sources. The consequences need to be restructured to appreciate career promotion by way of active scholarship and their manifested policy or industrial affiliation.

Behavioral Scientists: The fact that this sector is almost not integrated into the macro-system is a key explanatory variable in the implementation gap. Powerful contingencies such as funding, publication outlets, professional networks, direct expertise to the already existing spheres of knowledge such as healthcare and thus generate a small number of antecedents and outcomes of interacting with macro-sustainability issues (Davan Wetton et al., 2025). The behavioral systems science that is applied to sustainability policy and innovation is the target behavior. The development of this capacity needs to be done by building new antecedents (specialized training directories, specific conference tracks) and consequences (specific grant programs by environmental organizations, behavioral sustainability research journals).

The transformational quality of BSA is manifested by its ability to trace the interdependences between these redesigned sectors. There is an opportunity to direct innovative behavior by policymakers by setting grant criteria. The production of interdisciplinary experts by academic institutions provides the human capital required by the policymakers, which brings about a reinforcing effect. It is the integrated behavioral scientists who offer the critical methodology to assess, and repeat-cycle optimize such systemic loops. It, in turn, allows resolving the empirical paradox: the positive quantile correlation indicates cases when such sectors coincide by chance, whereas the negative IV-GMM effect reveals the default condition of such an outcome. BSA transforms a diagnostic understanding to a prescriptive machine of a sustainable productivity revolution by offering a blueprint that is used to intentionally organize this alignment.

6. Conclusion

The paper has engaged in systematized research on the sustainability nexus structure in the G7 countries between 2002 and 2020. Using a sequential explanatory mixed-methods design, the study first quantified the complex interrelations between the economic, environmental, social, and technological determinants and their impact on Sustainable Development Goals (SDGs) and then prescribed intervention interventions based on the analysis of the behavioral systems that underlie the main findings. Both critical and paradoxical findings were obtained through the macro-econometric diagnosis process. These analyses supported the predetermined, optimistic functions of economic variables and general technological advancement in the evolution of SDG achievement, but, at the same time, unveiled a complex environment. The environmental variables were only significantly positively related under the distributional view (Panel Quantile Regression) but not from a social perspective. Most significantly, it was found that the paradox of green innovation was its strong positive cross-sectional relationship with SDG levels but a strong negative marginal causal effect across time (IV-GMM coefficient: -0.0058). This paradox is no statistical modelling artifact but is the empirical signature of any significant implementation gap, and hence it is a fact that although green innovation is still a symbol of high-performing sustainable economies, existing incentive and implementation systems are dysfunctional, and often perversely counterproductive, metric oriented or siloed performance that negates holistic improvements. The above diagnostic stalemate necessitated a second research step, and Behavioral Systems Analysis (BSA) implemented through the Matrix Project template. The quantitative paradox, as translated into a prescriptive blueprint by the study, was that by changing the analytic unit of a country indicator to the antecedent-behavior-consequence contingencies in major sectors, we achieve the change of paradox into a blueprint. The discussion has added how the gap is sustained by the misaligned contingencies in four main areas, namely, the Innovators and Industry, Policymakers, Academic Institutions, and Behavioral Scientists. An example is the

rewarding process to innovators which can be measured by the number of patents but not by quantifiable net impact; conversely, the policymakers have contingencies that put a premium on short term increment of GDP as opposed to integrated well-being. The synergistic value of this paper is thus two-fold in its nature: it provides 1) a solid empirical support of systemic malfunctioning in the green growth nexus, and 2) a behavioral blueprint of its redesign. The BSA framework recommends specific interventions, including redesigning R&D grant criteria to require lifecycle impact assessment, developing political incentives to achieve multidimensional policy results and professional contingencies to incorporate behavioural scientists into sustainability governance.

6.1 Policy Imperatives

The results demand a radical shift in the mode of government between the disjointed programs to the design of interlocking behavioural systems. The policy should initially re-engineer incentives to innovations, whereby subsidies on generic components of green production are replaced with grants that require pre-registered carbon reduction and social equity measures, supported by purchase of SDG-related procurements and labeling of consumers. At the same time, the governance models must be redesigned to use interdisciplinary policy laboratories and well-being budgeting models that value cross-departmental cooperation with long-term and multidimensional returns instead of short-term economic outcomes. Most importantly, capacity building should require the incorporation of behavioural systems science in school curricula and research funding and create careers by which professionals could be encouraged to address gaps in implementation. Lastly, adaptive feedback loops (e.g., a requirement to periodically perform policy pre-mortems through Behavioural Systems Analysis and independent monitoring agencies) will need to be institutionalized to allow learning and facilitate the process of policy iteration based on behavioural and outcome data.

6.2 Limits and Future Projections

Although this study provides a new integrated framework, it still has its basic limitations, which propose some essential areas of research in the future. It is analytically strategic by focusing on the G7, which does not directly apply to the developing economies where institutional contexts and sustainability trilemmas are fundamentally different. In addition, complex constructs such as the concept of green innovation are measured using proxy indices, though methodologically correct, could be confusing qualitative differences between symbolic, incremental, and transformative innovations on which the paradox under study can be attributed. Of greatest importance, behaviour systems blueprint, despite its strong theoretical support, and empirical foundation, still needs empirical validation through application. Experimental pilot studies of contingency redesigns in living policy labs, the extension of the integrated diagnostic-prescriptive framework to emerging economies, and the measurement methodology to reflect the subtle typology of green innovation should be therefore the major focus of future research. In this manner the academic community will be able to move beyond diagnosis of systemwide failures to the empirical engineering of behavioural architectures that will be required to comprise a sustainable productivity revolution.

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Ethics

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