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Article — Published Version

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Business Strategy and the Environment

Provided in Cooperation with:
John Wiley & Sons

Suggested Citation: Olteanu, Yasmin; Fichter, Klaus (2022) : Startups as sustainability transformers: A new empirically derived taxonomy and its policy implications, Business Strategy and the Environment, ISSN 1099-0836, Wiley, Hoboken, NJ, Vol. 31, Iss. 7, pp. 3083-3099, https://doi.org/10.1002/bse.3065

This Version is available at:
https://hdl.handle.net/10419/266707

Received: 10 August 2021 | Revised: 2 March 2022 | Accepted: 15 March 2022

DOI: 10.1002/bse.3065

RESEARCH ARTICLE

Business Strategy and the Environment

WILEY

Startups as sustainability transformers: A new empirically derived taxonomy and its policy implications

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Funding information
Deutsche Bundesstiftung Umwelt, Grant/Award Numbers: AZ 33405/01, 33405/01

Abstract

For research as well as policymakers aiming at fostering multilevel transitions toward sustainability, there is a clear need to better understand the transformative role and relevance of startups as newcomers in the market. The existing typologies of sustainable entrepreneurship and green startups have been derived from theory and are conceptual or anecdotal in nature. The lack of validity and generalizability is a major research gap, as the existing typologies do not provide a sufficient basis for policy decisions on how to promote which type of entrepreneurship to effectively support specific transition policies. Against this backdrop, we investigate the research question: Does the transformation orientation differ among startups, and if so, how can they be clustered as basis for sustainability transition policy? Based on a sample of 1674 startups and cluster analysis, the paper makes three important contributions: First, we provide a differentiated perspective and empirical data on the transformation orientation of newcomers. Second, we provide an empirically founded taxonomy of the transformative orientation of startups and contribute to theory-building of transformative entrepreneurship. Third, we test the assumption inherent in most existing frameworks that there exists a high-potential subgroup of startups. Our results confirm the existence of a clearly distinguishable subgroup with a particularly high transformation orientation, which we label as "*sustainability transformers*." In terms of transition strategies, policymakers can build on our findings to adjust public funds and support programs in favor of specific subgroups such as *sustainability transformers*.

KEYWORDS
cluster analysis, multilevel transition, sustainable entrepreneurship, sustainable startup, transformation orientation, transformative entrepreneurship

1 | INTRODUCTION

One key element in the facilitation of the multilevel challenge of sustainability transitions (Geels, 2010) is the development, implementation, and diffusion of radically new or significantly improved goods/services, processes, or practices which, for example, reduce the use of natural resources or increase societal inclusion (EIO, 2013). Thus, environmental and social innovation is considered key for transformation processes toward sustainable development (Johnson & Schaltegger, 2019). Businesses and entrepreneurs can play

Abbreviations: EO, entrepreneurial orientation; KPI, key performance indicator.

an important role in this process (Köhler et al., 2019; Van De Poel, 2000), especially when pursuing more than just the financial bottom line with their *hybrid* ventures that in addition to financial sustainability consider social and/or environmental goals (Hahn & Ince, 2016). Of particular importance in this regard are those ventures which follow all three missions and relate their core business activities to the Sustainable Development Goals (United Nations General Assembly, 2015) or guiding concepts of sustainable entrepreneurship (Muñoz & Cohen, 2018; Patzelt & Shepherd, 2011; Schaltegger et al., 2018). These high-potential actors for sustainable development transitions are the object of sustainable entrepreneurship research (Schaltegger & Wagner, 2011). In sustainability transition research, it is acknowledged and well investigated that newcomers often drive radical innovation (Lauber & Jacobsson, 2016; Wesseling et al., 2014) and that the introduction of radical environmental product and service innovations to the market is more the realm of startups while incumbents are more focused on incremental environmental innovation (Fichter & Clausen, 2013).

For sustainability transition research (Köhler et al., 2019), sustainable entrepreneurship research as well as policymakers aiming at fostering multilevel transitions toward sustainability, there is a clear need to better understand sustainable startups as a special sub-type of new ventures, for three main reasons: First, for the development and introduction of radical sustainable innovations in transition pathways startups are of particular importance. Here, a *startup* is defined as a venture which is "young, innovative and growth-oriented" (Dee et al., 2015, p. 8). Second, for sustainability transition strategies, for example, in regard to climate mitigation and adaptation policies, it is important to know whether the transformative potential differs among sustainable startups and whether there are *"high potentials"* in regard to market transformation and environmental or social impact (Schaltegger et al., 2016). Third, for the effective use of public funds in startup support programs, it is relevant whether sustainable startups have to be addressed, supported and financed differently (Wagner et al., 2019). Against this background, an important question is as follows:

Does the transformation orientation differ among startups, and if so, how can they be clustered as basis for sustainability transition policy?

Sustainable entrepreneurship research provides various theory-derived typologies and empirically based taxonomies, which differentiate types of entrepreneurs and startups (Bergset & Fichter, 2015; Hockerts & Wüstenhagen, 2010; Nikolaou et al., 2018). Also, initial empirical investigations suggest that hybrid startups are not a homogeneous group (Dickel, 2018; Olteanu & Fichter, 2020) but differ in many regards, for example, the priority of environmental and social goals or the intended or actual effect of the company on markets and society (Schaltegger & Wagner, 2011).

The rich array of typologies and taxonomies for green and sustainable entrepreneurship uses very different dimensions and criteria to delineate different types of entrepreneurs or ventures. With regard to sustainability transition strategies, two dimensions seem to be especially important. The first relates to the effect of a company on market and society. It indicates the transformative potential of incumbent firms, startups and business models (Schaltegger et al., 2016). The second dimension differentiates the priority of environmental and social issues as business goals. "Companies contribute most to the sustainable development of an economy and society if their core business deals with solutions to environmental and social problems." (Schaltegger & Wagner, 2011, p. 227). This second dimension is an indicator for the strategy of a company and its willingness to bring about sustainable change.

The existing typologies of sustainable entrepreneurship and green startups have been derived from theory and are conceptual or anecdotal in nature. As a result, they have not been tested against empirical data and large samples, and it remains unclear to what extent the proposed types of entrepreneurs and ventures can actually be observed and delineated in reality. The lack of validity and generalizability is a major research gap, as the existing typologies do not provide a sufficient basis for policy decisions on how to promote which type of sustainable entrepreneurship to effectively support specific transition policies and defined sustainability goals. Little is known to date about high-potential actors for sustainability transitions. With this in mind, the purpose of our investigation is to generate a taxonomy of startups in terms of their transformative potential based on a large data set. This paper aims at determining if a sustainable high-potential change-agent subgroup can be identified and clearly demarcated from other startups using empirical data. The purpose of the study is therefore to establish a valid and generalizable taxonomy as a basis for informed decisions about transition policies and programs to promote new venture creation and sustainable startups.

This paper makes three important contributions: First, we provide a differentiated perspective and empirical data on the transformation orientation of newcomers in sustainability transitions. In doing so, we address a research gap in sustainability transition research and provide insights on "factors that accelerate or decrease the pace of change" (Köhler et al., 2019, p. 12). Second, to our knowledge, typologies suggesting that startups can be clearly demarcated into different categories according to their commitment to their respective bottom lines have not yet been tested using quantitative empirical data. Thus, we provide an empirically founded taxonomy of the transformative potential of startups for sustainability transitions and contribute to theory-building of transformative entrepreneurship. Furthermore, the analysis can validate and/or enhance the theory-derived frameworks. Third, the study tests the assumption inherent in a number of existing frameworks that there exists a high-potential subgroup of sustainable startups. The results can thus be important for policies aiming at fostering the transforming power of young enterprises as well as for designing effective public startup support programs. In addition, the findings also enable further research on this particularly interesting group of sustainable startups.

The remainder of this paper is structured as follows: Section 2 introduces relevant theoretical concepts and existing typologies and taxonomies for sustainable entrepreneurs and startups and develops the hypotheses for our study. The methodology and data used are presented in Section 3, followed by the results of the analysis in

Section 4. Section 5 presents the discussion, and Section 6 concludes with potential implications for policy and research.

2 | THEORY

2.1 | Concepts of transformative entrepreneurship

"Ever since Schumpeter put the entrepreneur at the center of progress, scholars have highlighted the transformational role that entrepreneurship plays in generating economic and social wealth." (Tobias et al., 2013, p. 729). The notion that entrepreneurial activity can lead or contribute to significant societal and environmental change has been taken up in sustainability transition research (Burch et al., 2016), social entrepreneurship research (Mair et al., 2012), and in sustainable entrepreneurship research (Johnson & Schaltegger, 2019). Tobias et al. (2013, p. 728) define transformative entrepreneurship "as the process of addressing and ultimately transforming conditions of protracted socioeconomic constraint through entrepreneurship."

While transition research in the subfield of business and industry has until now been focused on the role of business actors in developing niche innovations, their role in facilitating institutional change and the relations and struggles between newcomers and incumbent actors (Köhler et al., 2019), recent work from sustainable entrepreneurship research develops a more comprehensive picture of transformational mechanisms: "Entrepreneurship for sustainable development is a multilevel phenomenon connecting social, environmental and economic dimensions between entrepreneurial processes, market transformations, as well as large-scale societal developments." (Johnson & Schaltegger, 2019, p. 1). The different multilevel transformational mechanisms stimulated or implemented by entrepreneurs comprise mechanisms between the micro and the meso level, such as transforming markets toward sustainable development (Hockerts & Wüstenhagen, 2010; Schaltegger et al., 2016), as well as mechanisms between the micro and the macro level, for example, creating new sustainability-oriented institutions (Pacheco et al., 2010; Pinkse & Groot, 2015). Johnson and Schaltegger (2019) provide a framework for multilevel causal mechanisms by entrepreneurship for sustainable development and have identified seven different *transformational mechanisms* (see Section 2.1). These help to describe and explain the entrepreneurial role in multilevel transitions toward sustainability.

This study builds on their assumption that entrepreneurial activity can have a multilevel transformational capacity toward sustainable development and aims at identifying those startups with the largest potential.

Within the concept of entrepreneurship for sustainable development from a multilevel transition perspective, Johnson and Schaltegger (2019, p. 4) relate the entrepreneurial role to the concept of "causal mechanism," which they define as "the processes through which an outcome is brought about." They build on analytical sociology research where *mechanisms* are conceptualized as entities (e.g., entrepreneurs) and the activities that these entities engage in. "These activities bring about change …" (Hedström & Wennberg, 2017, p. 94). Causal mechanisms can be organized along multilevel categories, including (i) situational mechanisms, (ii) action-formation mechanisms, and (iii) transformational mechanisms (Hedström & Wennberg, 2017). Specifically transformational mechanisms are relevant for the specification of transformative entrepreneurship: "… transformational mechanisms explain the collective effects of multiple ventures (micro-level) on markets (meso-level) and grander institutional landscapes (macro-level)." (Johnson & Schaltegger, 2019, p. 3). Based on an extensive literature review, Johnson and Schaltegger (2019) identify seven transformation mechanisms through which entrepreneurs can contribute to changes on a macro and meso level:

Macro level

- Transforming institutions toward sustainable development
- Creating large-scale sustainability value
- Creating sustainability-oriented institutions

Meso level

- Transforming markets toward sustainable development
- Creating sustainability-oriented networks
- Presenting sustainability-oriented market innovations
- Creating local sustainability value.

Based on these foundations, we define the term *transformative entrepreneurship* as follows:

> *Transformative entrepreneurship is the process of addressing and ultimately transforming conditions that contribute to sustainability transitions in markets (meso level) and the grander institutional landscape (macro level) through entrepreneurship. In this vein, transformative entrepreneurship implements a causal transformational mechanism and can be considered to be a specific form or function of sustainable entrepreneurship.*

When relating transformative entrepreneurship to the actor type of startups, some specifications are needed. Startups are in a very early phase of the entrepreneurial lifecycle. This leads to particular challenges in clarifying whether or not their activities are transformative. It is pointed out in the literature that it is typical for startups that evolving product and service designs, material choices, and supply chains are subject to rapid and substantial changes in the short term (Clarke-Sather et al., 2011; Picken, 2017). The resulting volatility in business model and value chain leads to great uncertainties and requires a high level of flexibility of the startups and their stakeholders (Ries, 2011). A further assessment challenge arises from the fact that startups are new to the market (Skala, 2019). Therefore, startups lack previous performance data based on which

assessments can be carried out (Judl et al., 2015). Consequently, the assessment whether startups actually contribute to sustainability transitions "is much more a question of predictive, modeling-based, ex ante evaluation than of retrospective, experienced-based, ex post evaluation which applies to established companies." (Trautwein, 2021, p. 3). This means that the transformative character of startups should focus on their potential to contribute to sustainability transitions in the future. When it comes to forces that influence the success of young ventures in the market and the impact on society and the environment, the startup-team and its entrepreneurial orientation is a key factor (Dickel, 2018; Su et al., 2011). Based on these insights and the resource-based view of the firm (Barney, 1991, 2001) and its extension to a dynamic capability perspective (Schilke et al., 2018; Teece et al., 1997), commonly used in entrepreneurship research with regard to venture internal factors that allow predictions about the growth and impact of young ventures (Horne & Fichter, 2022), we introduce the concept of *transformative capacity* of startups and define it as follows:

> *The transformative capacity of a startup comprises the resources, competencies and entrepreneurial orientation of a venture team which enables it to contribute to sustainability transitions in the future by implementing transformational mechanisms*.

We argue that entrepreneurial orientation plays a critical role in realizing a startup's transformational capacity and translating its potential into real impacts on markets, society, and the natural environment, as it significantly increases the likelihood that a startup will remain *on track* with respect to its intended impacts. Entrepreneurial orientation (EO) has emerged as a major construct within management research over the past three decades, and it has become a widely accepted means of explaining the diversity in firm performance (Su et al., 2011). EO refers to the "processes, practices, and decision-making activities that lead to new entry" (Lumpkin & Dess, 1996, p. 136) and encompasses three important dimensions: proactiveness, innovativeness, and risk-taking (Su et al., 2011, p. 559 f.). The entrepreneurial orientation construct has also be applied in sustainable entrepreneurship research (Dickel et al., 2018; Kuckertz & Wagner, 2010). Here, the construct of *"environmental orientation"* is used. It encompasses a firm's acknowledgment of its responsibilities concerning the natural environment, the importance a firm assigns to the environmental impact of its activities, and the perceived need to minimize negative environmental impacts (Banerjee, 2002; Dickel et al., 2018). Based on this earlier work, we introduce the construct of *"transformation orientation"* and define it as follows:

> *Transformation orientation encompasses an entrepreneurial team's or a firm's acknowledgment of its responsibilities concerning the society and the natural environment and the importance it assigns to transformational mechanism and positive economic, social and ecological impacts*.

The construct is based on important entrepreneurial dimensions such as proactiveness, innovativeness, and risk-taking (Su et al., 2011) as well as on the prioritization of (planned) environmental and societal impact and (planned) market impact. Transformation orientation can be considered an essential element of a startup or firm's transformational capacity. It essentially reflects the underlying attitudes and convictions and provides a link between entrepreneurial intention focused on sustainable development and firm performance and impacts (Kuckertz & Wagner, 2010).

After clarifying the concept of transformative entrepreneurship and the notion of the transformative capacity and orientation of startups, we now more closely examine to what extent the proposed typologies and taxonomies of sustainable entrepreneurship entail types of transformative entrepreneurship.

2.2 | Typologies and taxonomies of sustainable entrepreneurs and startups

Sustainable entrepreneurship has been found to be shaped by a variety of drivers, among them input-related ones, for example, environmental orientation (Dickel et al., 2018), activity-related ones, for example, drivers for green product development (Dangelico, 2017) and the financing means (Bocken, 2015), output-related ones, for example, sales growth or company size (Hoogendoorn et al., 2015), and outcome/impact-related ones, for example, the reaction of competitors (Schaltegger & Wagner, 2011) and market share (Hörisch, 2015). Against this backdrop, we reviewed previous conceptual work for existing typologies and taxonomies to enable us to describe and identify different types of sustainable entrepreneurs and startups.

Academic research on sustainable entrepreneurship predominantly focuses on the characteristics, actions, and outcomes of entrepreneurs who engage in sustainable business activities (Terán-Yépez et al., 2020). In order to delineate different typologies and taxonomies, we build on a table structure provided by Bergset and Fichter (2015). They describe typologies and taxonomies by their main characteristics, the actor type, the type of organization, the central social unit, and the main purpose of the typology or taxonomy. We added two aspects that we considered additionally relevant for this paper: first, the methodological origin of the typology or taxonomy, which can be theoretically derived (typology) and/or empirically established on the basis of quantitative and/or qualitative data (taxonomy), and second, the consideration of the concept of transformation and sustainability transition.

Table 1 provides an overview of the typologies and taxonomies reviewed. It demonstrates that the existing ones that clearly consider aspects of transformation and the transformative capacity of young ventures have predominantly been derived from theory. None of the empirically established taxonomies is based on a large quantitative data set.

With regard to the multilevel sustainability transition, outcome and impact-related aspects of transformative capacity and effects of

TABLE 1 Typologies and taxonomies for sustainable entrepreneurship (based on Bergset and Fichter (2015); amended by the authors)

Author (year) "name of typology/taxonomy"	Main characteristics of typology/taxonomy	Actor types	Type of organization (central social unit)	Main purpose of the typology/taxonomy	Methodological origin (consideration of transformation)
Isaak (1998) "Green-green business"	Degree of environmental orientation of a company's core business	• Green business • Green-green business	Startups and incumbents (organizations)	Development of strategies for promotion of ecopreneurship within private sector initiatives	Theory-derived (yes)
Linnanen (2002) "Environmental entrepreneurs"	Internal motivation: The desire to change the world and the desire to make money and grow the business	• Self-employer • Non-profit business • Opportunist • Successful idealist	Startups (mixture of organizations and individuals)	Unspecified	Empirically established: Qualitative (no)
Schaltegger (2002) "Ecopreneurs"	Degree of environmental orientation of a company's core business and the market impact of the company	• Environmental administrator • Environmental manager • Alternative actors • Bioneers • Ecopreneurs	Unspecified (individuals and their role in a company)	Framework provides a reference for managers to introduce ecopreneurship	Empirically established: Qualitative (yes)
Walley and Taylor (2002) "Green entrepreneurs"	Internal motivation and external (hard and soft) structural influences	• Innovative opportunists • Visionary champions • Ethical mavericks • Ad hoc enviropreneurs	Unspecified (interrelationship between persons and external structures)	Contribute to further research into ways of fostering green entrepreneurship	Theory-derived (yes)
Zahra et al. (2009) "Social entrepreneurs"	Type of market and societal impact	• Social bricoleur • Social constructionist • Social engineer	Unspecified (individuals)	Assess the level (local vs. global) and type of (small-scale, institutional, "revolutionary") impact	Theory-derived (yes)
Freimann et al. (2010) "Ecopreneurs"	Type and amount of environmentally friendly business measures implemented at the start	• Eco-dedicated startups • Eco-open startups • Eco-reluctant startups	Startups (mixture of organizations and individuals)	Discovering opportunities for implementation of environmental management from the beginning of a company	Empirically established: Qualitative (no)
Hockerts and Wüstenhagen (2010) "Sustainable entrepreneurs"	Degree of environmental orientation of a company's core business and reach due to market presence	• Davids • Goliaths	Startups and incumbents (organizations)	Demonstrate the different, but complementary roles of incumbents and new ventures in sustainable entrepreneurship	Theory-derived (yes)

(Continues)

TABLE 1 (Continued)

Author (year) "name of typology/taxonomy"	Main characteristics of typology/taxonomy	Actor types	Type of organization (central social unit)	Main purpose of the typology/taxonomy	Methodological origin (consideration of transformation)
Schaltegger and Wagner (2011) "Sustainable Entrepreneurship"	Two dimensions: Degree of effect of company and degree of priority of environmental and societal goals	• Administration of social or/and environmental requirements • Management of social/environmental challenges/opportunities • Traditional social entrepreneurship • Sustainability innovation in a niche (Bioneers) • Institutional entrepreneurship • Ecopreneurship • Sustainable entrepreneurship	Startups (organizations)	Framework to position different kinds of environmental and socially responsible activities of companies	Theory-derived (yes)
Lepoutre et al. (2013) "Social entrepreneurs"	Presence of "social mission" and type of revenue model	• Traditional NGO • Not-for profit social enterprise • Social hybrid • Social enterprise • Economic enterprise • Hybrid social enterprise • For profit social enterprise	Startups and incumbents (organizations)	Enabling empirical research of social enterprises at the macro level	Empirically established: Quantitative (no)
Bergset and Fichter (2015) "Green Startups"	Characteristics in three aspects: Product-, entrepreneur-, and strategy-related	• Alternative startup • Visionary startup • Inventive startup • Ecopreneurial startup • Unintentionally green startup	Startups (interrelationship between key individuals and key organizational characteristics)	Framework for empirical research on financial challenges and opportunities of green startups	Empirically established: Qualitative (no)
Jolink and Niesten (2015) "Sustainable Development and Business Models of Entrepreneurs in the Organic Food Industry"	Environmental scope of product lines and focus on mass market/profitability	• The income model • The subsistence model • The growth model • The speculative model	Individuals	Varieties of the ecopreneurial business model	Empirically established: Qualitative (no)
Nikolaou et al. (2018) "Green Entrepreneurs"	External factors (institutional theory) and internal factors (resource-based view)	• Institutional green entrepreneur • Idealistic green entrepreneur • Strategic-driven green entrepreneur • Innovative green entrepreneur	Unspecified (individuals)	Framework of key factors that stimulate entrepreneurs to invest in green entrepreneurship	Theory-derived (no)

companies in market and society are specifically relevant (Burch et al., 2016; Schaltegger et al., 2016). Therefore, typologies or taxonomies that use impact dimensions as classification criteria *and* consider the aspect of transformation are particularly useful. In this respect, the two approaches by Schaltegger as well as Schaltegger and Wagner (Schaltegger, 2002; Schaltegger & Wagner, 2011), emerged as the most suitable to address the research question of this paper. The authors focus on the two concepts of *ecopreneurship* and *sustainable entrepreneurship* as the most effective approaches to address sustainable development issues from an entrepreneurial point of view. These two business types can be classified as concepts of transformative entrepreneurship (Burch et al., 2016). They suggest that a differentiation of the degree of transformative capacity can be made according to and illustrated along two axes: the impact on the market and the impact on the social and environmental system in general. High values on both axes indicate a higher transformative capacity of the observed startup. We will develop the respective hypotheses for this study on this basis in the next section.

As Table 1 demonstrates, the existing typologies and taxonomies of sustainable entrepreneurship and green startups have either been derived from theory or are qualitative investigations limited to a very limited number of case studies. As a result, they have not been tested on empirical data and large samples, and it remains unclear to what extent the proposed types of entrepreneurs and ventures can actually be observed and delineated in reality. The lack of validity and generalizability is a major research gap, as the existing typologies and taxonomies do not provide a sufficient basis for policy decisions on how to promote which type of sustainable entrepreneurship to effectively support specific transition policies and defined sustainability goals. Therefore, we aim at developing a taxonomy of sustainable entrepreneurship that takes the transformative potential into account and is also based on the quantitative data analysis of a representative sample of startups.

2.3 | Development of the hypotheses

This study aims at answering the research question:

Does the transformation orientation differ among startups, and if so, how can they be clustered as basis for sustainability transition policy?

As outlined above (Section 2.1), it is not expedient for startups to use the actual outcomes and impacts as the relevant measures, but rather their respective potential. Here, we thus use the construct of *transformation orientation* as a core element of transformative capacity to investigate the potential for the sustainability transition. For the investigation of the transformation orientation, Schaltegger's (Schaltegger, 2002; Schaltegger & Petersen, 2000) earlier positioning matrix for ecopreneurship was found to provide particularly fitting dimensions. The positioning matrix uses two axes for categorizing companies: the market effect of the business (horizontal axis) and the priority of environmental goals (vertical axis). We build on these two dimensions yet adapt them to startups. In both dimensions, we also refer to the theory of change (Carman, 2010) and the concept of *impact* (Kurz & Kubek, 2016), to take into account not only the direct effects of the venture on stakeholders, but also its extended influence on markets, society and the environment at large (Wagner et al., 2019). The latter go beyond the micro level and constitute those changes on a meso and macro level which contribute to sustainability transitions. As a result, the horizontal axis displays the *dimension of the (planned) market impact* of a startup. The vertical axis represents the *dimension of prioritization of environmental and societal impact*. The two axes indicate the degree of transformation orientation of a startup and relate to system-level effects and intended positive externalities (Fichter et al., 2021). The resulting first hypothesis is as follows:

> **H1.** Startups can be classified into types that are clearly distinguishable based on their transformation orientation. The latter is expressed by their prioritization of environmental and societal impact and their (planned) market impact.

In addition, Schaltegger and Wagner's (2011) later positioning matrix for sustainable entrepreneurship suggests that a clearly divergent subgroup of startups can be identified: their business activities aim at having both strong effects on the market *and* society, and sustainability performance forms part of their core business. It is these startups which constitute *sustainable entrepreneurship* according to the framework and which would show the highest potential transformative capacities toward the sustainability transition as examined in this paper. We consequently formulate the second hypothesis:

> **H2.** There is a clearly distinguishable category of startups that is characterized by a very high transformation orientation. The latter includes both environmental/societal and market impact as a very high priority of a startup.

3 | MATERIAL AND METHODS

3.1 | Sampling scenario and questionnaire characteristics

We selected a quantitative research design to test our hypotheses. Due to research interest and data availability, the population of interest for this paper is specified as all Germany-based startups. A *startup* is defined as a venture which is "young, innovative and growth-oriented" (Dee et al., 2015, p. 8). In line with the definition of the German Startups Association our definition includes startups up to 10 years of age (Kollmann et al., 2018). There is currently no robust data on the population of interest defined in this way. The Green Startup Monitor 2018, however, estimates that at the end of the year 2018, roughly 23,700 startups in Germany fulfilled the three inclusion criteria: innovativeness, growth orientation and an age younger than 10 (Fichter & Olteanu, 2019).

We chose the database of the largest regular survey among German startup entrepreneurs: the German Startup Monitor as the sample for this paper. The Monitor's data are collected on a yearly basis by the German Startups Association, which disseminates the link to the online questionnaire via numerous relevant networks (e.g., business angels, venture capital investors, accelerators, incubators, and entrepreneurial support centers). Participation is anonymous. The data for 2020 was collected in the period May 11 to June 21, 2020 and includes answers from the founders or top managers of 1946 Germany-based startups (Kollmann et al., 2020). The yearly questionnaire is structured on the building blocks for startup success proposed by Kollmann (2006), namely, management, market access/network, processes, and product. These building blocks are completed by external dynamics related to politics, competition, infrastructure/networks, and society/culture. To be able to answer our research question, we initiated the integration of selected sustainability-related questions in the questionnaire.

3.2 | Questionnaire measures

All variables relevant for this study were measured on either a five-point or a six-point Likert scale (scales differed as an ex ante measure against common method variance; Chang et al., 2010; see Section 3.4). During data processing, we used a linear transformation to convert the variables to a −1 to 1 continuous scale for scale standardization.

The *dimension of* ***prioritization of environmental and societal impact*** was composed of four items:

1. The level of agreement to the statement: "Our products/services can be categorized as "Green Economy" because they specifically contribute to environmental, climate and resource protection" (5-point Likert scale)
2. The level of agreement to the statement: "Our products/services can be categorized as "Social Entrepreneurship", because they serve to solve social problems" (5-point Likert scale)
3. The level of strategic importance ("Which business strategies are currently important for your startup?") of "Achieving a positive social or environmental impact" (6-point Likert scale)
4. The level of agreement to the statement: "We integrate ecological and/or social effects into our key performance indicators (KPIs)" (5-point Likert scale)

The *dimension of the* ***(planned) market impact*** was composed of two items:

1. The level of strategic importance ("Which business strategies are currently important for your startup?") of "Rapid growth" (6-point Likert scale)
2. The level of strategic importance ("Which business strategies are currently important for your startup?") of "Achieving a high market share" (6-point Likert scale)

To form the constructs, we calculated the variable's average and then converted the values obtained to a continuous scale from −1 to +1. The 1674 startups answered all relevant survey questions and were thus included in the analysis. Table 2 displays the descriptive statistics of the variables and their correlations.

3.3 | Validity and reliability

An exploratory factor analysis (Principal Axis Factoring with a varimax rotation) was conducted to analyze and potentially consolidate the constructs. The analysis suggested two factors, which can be interpreted as the two dimensions this study aims to measure: *prioritization of environmental and societal impact* and *(planned) market impact*. The convergent validity of each construct was tested based on their composite reliability. (Planned) market impact showed a composite reliability below the cutoff point of 0.7. The reason might be the fact that this construct consists of only two items and the test is influenced by the number of items in the construct (Gosling et al., 2003). Based on the rather high factor loadings of the two items, we consider the construct still as valid. The items and scales used to assess the constructs are detailed in Table 3.

TABLE 2 Descriptive statistics of the continuous variables and correlation matrix

	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5	6
1—Green economy	.12	.68	−.20	−1.13	1	.32**	.41**	.47**	.04	.05*
2—Social entrepreneurship	.05	.68	−.10	−1.21	.32**	1	.51**	.47**	−.02	.09**
3—Strategy: Social or environmental impact	.40	.56	−.66	−.51	.41**	.51**	1	.64**	−.02	.13**
4—KPIs: Ecological and/or social effects	.19	.62	−.31	−.93	.47**	.47**	.64**	1	−.02	.06*
5—Strategy: Rapid growth	.46	.49	−.73	−.06	.04	−.02	−.02	−.02	1	.39**
6—Strategy: High market share	.42	.52	−.67	−.30	.05*	.09**	.13**	.06*	.39**	1

Note: $n = 1674$ observations; S.D.: standard deviation.
**Significance code: $p < .01$. *Significance code: $p < .05$.

TABLE 3 Items and scales used for the constructs

Constructs (composite reliability)	Items assessed in the questionnaire	Factor loadings
Prioritization of environmental and societal impact (0.773)	Green economy	0.539
	Social entrepreneurship	0.610
	Strategy: Social or environmental impact	0.797
	KPIs: Ecological and/or social effects	0.809
(Planned) market impact (0.555)	Strategy: Rapid growth	0.598
	Strategy: High market share	0.649

3.4 | Bias countermeasures

To avoid common method and source bias, we adopted ex ante as well as ex post countermeasures (Chang et al., 2010; Podsakoff et al., 2003, 2012):

- The participants were assured anonymity and confidentiality of their responses. The communicated aim of the questionnaire was the mapping of the German startup ecosystem, by this avoiding bias by social desirability. The questionnaire contained a multitude of categories and questions (see Section 3.1) and by this did not suggest a focus on sustainability or impact.
- The questions in the questionnaire were psychologically separated to avoid assumptions about goals or causal relationships by respondents. The variable blocks used in this study were placed distant from each other in the questionnaire.
- The use of different scales should prevent bias deriving from homogenous scales. The use of labels for each point in addition reduced a potential ambiguity in the respondents' answers.
- As an ex post measure, we used Harman's single factor test with a Principal Component Analysis. The first factor explained 40.78% of the variance, which suggests a rejection of the presence of common method bias.

3.5 | Data analysis

The objective of this study was to test whether there exist clearly demarcable subgroups among the startups in the dataset (as opposed to simply mapping them on a continuum of two axes). Two considerations lie at the base of the decision for a concrete technique: How powerful is the method regarding defining groups that show a maximum within-group similarity and maximum between-group differences? And can the method detect relationships between the predefined criterion measures? Structural methods typically cater to the first consideration, functional methods to the second. The two-step cluster analysis offers the benefits of both, structural and functional techniques. In addition, it supports ordinal variables, which is not the case with many other methods, such as, for example, BIRCH (Zhang et al., 1996) and its algorithm was found to behave reasonable well also with non-normally distributed variables (Garson, 2014). We thus considered it the most suitable method to test our hypotheses.

The two-step cluster analysis defines pre-clusters in its first step (creating a cluster feature tree) and in the second step treats the pre-clusters as single cases introducing hierarchy (by agglomerating the leaf nodes of the tree). One of its strengths is the possibility to determine the number of clusters automatically based on the data, by this avoiding potential bias (Bacher et al., 2004; Everitt et al., 2011). For the automatic calculation of the optimal number of clusters, in the first step of the cluster analysis Schwarz's Bayesion Criterion was calculated for each number of clusters resulting in an initial estimate of the numbers of clusters. This estimate was in the second step improved by defining the largest increase in distance between the two closest clusters. As our dimension-variables are metric (see Section 3.2), the Eucledian distance measure was applied at this step (Norušis, 2008). To test the stability of our final cluster solution with different case orders, we reordered the cases twice (once based on the founding years of the startups and once on the city of registration) and repeated the analysis. The solution remained the same, suggesting that the cluster solution can be considered stable.

We then arranged the resulting clusters and labeled them in a suggested positioning matrix. By this, we provide a taxonomy for transformative entrepreneurship based on transformation orientation.

3.6 | Descriptive statistics

With an average age of 2 years, the 1674 examined startups were quite young at the time of the survey. Their founders have a relatively high level of education: 76% of all founders hold a university degree. The 28% of all founders completed a master's program. The 42% of the founders have an economics or business background, followed by engineers (20%) and computer science (15%). Other majors, such as natural sciences, humanities or design, account for only less than 10% each. Information and communication technology is the by far largest industry sector in the sample (34%), followed by medicine and health (10%), nutrition (6%) and consumer goods (5%). The business models show the entrepreneurs' affinity for technology: 29% engage in software-as-a-service, 20% in an online platform, 17% in the development and production of technology hardware and 11% in software development. In total, 86% of the startups operate a digital business model. Despite their young age, most startups in the sample are employers: three out of four currently employed personnel that is not part of the founding team. These figures show that our sample largely reflects the startup scene in Germany as described in the German Startup Monitor 2020 (Kollmann et al., 2020).

4 | RESULTS OF THE ANALYSIS

4.1 | Cluster analysis

The two-step cluster analysis was run on the 1674 startups for which all values are available. It results in an optimum of six clusters for the

analyzed data. The likelihood distance measure at this point is 1.702. The smallest cluster comprises 157 cases, the largest 289 cases The resulting relationship between them is 1.84, which is a good value (Norušis, 2008). The model fit was evaluated using the silhouette coefficient, a measure of cohesion and separation of clusters. It ranges between minus 1 and 1. A value above 0 indicates a validity of the within- and between-cluster distances (Norušis, 2008). The silhouette coefficient of our analysis is 0.5 and thus suggests that the quality of the created clusters is high (Norušis, 2008).

A Pearson Chi-squared test validates the statistical significance of the clusters' variations over the two segmentation variables "*(planned) market impact*" ($p = .000$) and "*priority of environmental and societal impact*" ($p = .000$). Hypothesis 1 is hence confirmed: *Startups can be classified into types that are clearly distinguishable based on their transformation orientation (expressed by their prioritization of environmental and societal impact and their (planned) market impact).*

The distribution of the clusters and the cluster averages of the segmentation variables per cluster are shown in Table 4. A higher average indicates a stronger prioritization of the respective dimension. A * indicates the variable that has the greater relative importance in distinguishing that particular cluster from its nearest neighbor based on a chi-square plot and higher chi-square values. It thus marks the most significant differentiator for that cluster.

These cluster averages are in the next step of analysis used to plot the clusters over the *positioning matrix for transformative entrepreneurship*.

TABLE 4 Description of the clustered startups

			Cluster average dimension values between −1 (low) and 1 (high) * = strongest differentiator	
Cluster	***N***	**% of the combination**	**(Planned) market impact**	**Priority environmental and societal impact**
1	177	10.6%	0.0237*	0.1369
2	184	11.0%	0.3109	0.6115*
3	157	9.4%	0.9236*	0.7621
4	289	17.3%	0.7349*	0.3346
5	226	13.5%	0.4159	−0.2260*
6	164	9.8%	0.8927*	−0.1306
Outlier	477	28.5%	0.1560	0.0839
Combined	1674	100%		

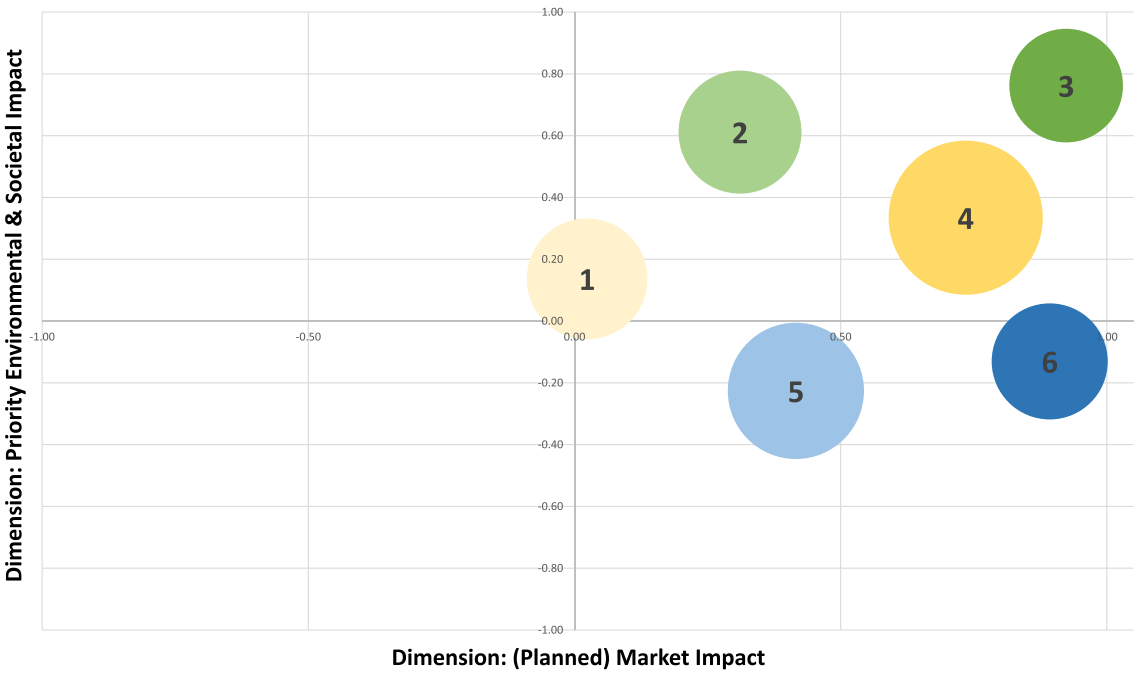

FIGURE 1 Plotting of the clusters over the two dimensions of "(planned) market impact" and "priority environmental and societal impact"

4.2 | A taxonomy of transformative entrepreneurship

The plotting of the clusters as bubbles over the positioning matrix displays their distribution over the two relevant dimensions, which together stand as proxy for the transformation orientation. By this, we provide a taxonomy of transformative entrepreneurship based on transformation orientation. The size of each cluster is reflected in the size of the bubble. The plotted matrix is shown in Figure 1. It shows a tendency toward rather high (planned) market impact and a neutral to strong prioritization of environmental and societal impact.

The 10% of the startups are members of Cluster 6. It is characterized by high (planned) market impact (on average 0.89) and a neutral to negative stance toward environmental and societal impact as a priority (on average −0.13). The members of Cluster 1 can hence be assumed to be first and foremost growth-oriented young enterprises. The members of the cluster are thus labeled *growth-only-ventures*.

Cluster 5 represents 14% of the startups. The cluster is characterized by the fact that its members share a moderate ambition toward market impact (0.42) and reject environmental and societal impact as a priority (−0.23), suggesting that they merely follow law and regulations in regard to their effects on society and environment. The startups in this cluster are consequently labeled *market-focused ventures*.

Cluster 1 comprises the 11% of the startups which show comparatively low values in the dimension "*(planned) market impact*." The average startup in this cluster takes a neutral stance in this dimension. These startups thus do not strive for high market shares but follow an alternative or niche approach. Regarding environmental and societal impact, the cluster is very diverse: its members range from very little to very strong consideration of impact, with the average at 0.14. The cluster can thus be assumed to group all those startups with low growth ambitions, yet different degrees of environmental and societal impact ambitions. We thus label them *non-growth ventures*.

Cluster 4 with 17% of the startups is the largest cluster in the analysis. It is characterized by a clear prioritization of market impact (0.73), which is however less pronounced than for the *growth-only-ventures*. These startups take into consideration their environmental and societal impact, yet do not prioritize it (0.33). The members of the cluster can hence be assumed to actively seize business opportunities and manage risks associated with society and the environment, but with a primary focus on growth and market shares. In line with Schaltegger and Wagner's framework (2011), their impact goals can be expected to be an *addition* to the core business. We therefore label the cluster *sustainability-sensitive ventures*.

Cluster 2 with 11% of the startups, includes members that show a limited prioritization of their (planned) market impact (0.31). Yet the dimension of environmental and societal impact, with an average of 0.61, is evidently prioritized and can be expected to be part of these young companies' core business goals. With these characteristics, the members of the cluster share many attributes with one category of Schaltegger and Wagner's framework: Bioneers that aim at market leadership in their niche. We thus label the cluster *biopreneurs*.

Lastly, Cluster 3 is comprised of a clearly distinguishable subgroup of hybrid startups that attribute a high priority to both dimensions examined: the (planned) market impact (0.92) and their environmental and societal impact (0.76). The members of the cluster thus can be expected to not only aim at high market shares in the mass market, but also strive to have an impact beyond the market on society and the environment because sustainability is at the core of their business.

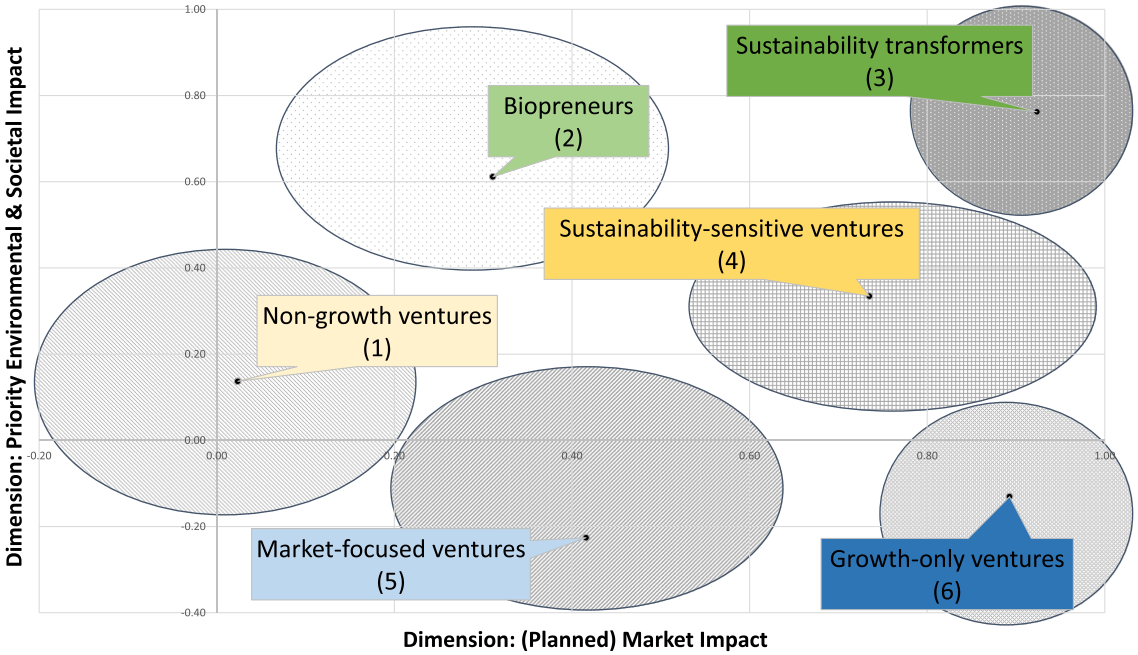

FIGURE 2 A taxonomy of transformative entrepreneurship based on transformation orientation

Its members can hence be regarded as *sustainability transformers*. One hundred fifty-seven of the examined startups, or 9%, can be attributed to this cluster.

Figure 2 displays the taxonomy of transformative entrepreneurship based on transformation orientation with the introduced labeled cluster types, the cluster averages and their approximate scatter ranges.

Summing up, the analysis resulted in a taxonomy of six clearly distinguishable clusters of startups, thereby confirming Hypothesis 1. The analysis further suggests that there is one distinguishable category of startups combining both very high (planned) market impact and very high priority for environmental and societal impact. Hypothesis 2 is hence also confirmed. It is these *sustainability transformers* that hold the greatest transformation orientation for the multilevel sustainability transition.

Table 5 describes the resulting *taxonomy of transformative entrepreneurship based on transformation orientation* in a comparable fashion to the existing typologies and taxonomies presented earlier, thereby adding the result to the body of knowledge on sustainable entrepreneurship.

5 | DISCUSSION

In the following, we discuss our findings related to the role of businesses and newcomers in sustainability transitions using the typologies and taxonomies proposed by sustainable entrepreneurship research.

5.1 | A differentiated perspective on newcomers in sustainability transitions

Our findings suggest that there are significant differences between different types of startups in terms of their transformation orientation. Until now, no differentiation has been made among newcomers. They are treated more or less as a single homogeneous group. Our findings indicate that there is a need for a differentiated perspective and that there are clearly distinguishable types of newcomers. With regard to the need to understand and explain the pace of change of sustainability transition (Köhler et al., 2019), a differentiated perspective seems necessary. Our findings suggest that *sustainability transformers* are high potentials when it comes to transformative capacity. Moreover, the cluster types of *biopreneurs* and *sustainability-sensitive ventures* can be key partners in speeding up the diffusion of environmental innovation, which seems to be a key challenge for sustainability transitions (Clausen & Fichter, 2019). These insights also have implications for the role of financial capital in transition processes. Until now, the provision of venture capital and public funding schemes for venture growth are not specifically designed and adapted to impact startups (Köhler et al., 2019).

In terms of the role of startups in implementing transformational mechanisms, our findings can enhance the explanation of multi-level dynamics in sustainability transitions. Two aspects seem to be relevant here. First, given the specific character of startups as young ventures with limited resources, it is likely that they engage in transformation mechanisms more on a meso level than on a macro level. The latter usually requires significant resources and established networks that startups generally do not have. Second, the four transformational mechanisms on a meso level identified by Johnson and Schaltegger (2019) (see Section 2.1) are likely to be implemented only by specific types of startups. For example, it is unlikely that *non-growth ventures* will implement the transformational mechanism of transforming markets toward sustainable development. Given their low planned market impact and the high ambition to generate societal and environmental benefits, they are more likely to follow the transformational mechanism of creating sustainability-oriented networks and creating local sustainability value. On the other hand, *sustainability transformers* and *biopreneurs* seem to be the groups that take a strong lead in presenting sustainability-oriented market innovations

TABLE 5 Characteristics of the taxonomy of transformative entrepreneurship

Main characteristics of typology/taxonomy	Actor types	Type of organization (central social unit)	Main purpose of the typology/taxonomy	Methodological origin (consideration of transformation)
Transformation orientation: Degree of (planned) market impact and degree of priority of environmental and societal impact	• Sustainability transformer • Biopreneur • Sustainability-sensitive venture • Growth-only venture • Market-focused venture • Non-growth venture	Startups (Organizations)	Taxonomy of the transformation orientation of startups	Empirically established: Quantitative (yes)

and transforming markets toward sustainable development. Thus, research on transformational mechanisms needs a differentiated perspective on newcomers in sustainability transitions as well.

5.2 | Reflections on previous typologies and taxonomies which consider the concept of transformation

In Section 2.2 we gave an overview of the mainly theory-derived existing typologies and taxonomies for sustainable entrepreneurship, six of which consider the concept of transformation. In this section we reflect on how our findings relate to these and suggest aspects for theory-building which can be derived from this study.

Isaak's green-green business (1998) suggests that a high degree of environmental orientation and resulting startups which are "green in [their] processes and products from scratch" (1998, p. 82) act in a transforming way toward sustainable development. His typology is thus the only one which relies on a single dimension when identifying those startups with particular high transformative capacity. His green-green business type thereby encompasses two categories of the taxonomy of transformative entrepreneurship: the *biopreneurs* and the *sustainability transformers*. While, as discussed in Section 5.1, both types can be viewed as attractive partners for fostering sustainability transitions, our taxonomy can add an important differentiation between these types which might be relevant in cases in which decisions about allocating limited resources need to be made.

Walley and Taylor's green entrepreneurs typology (2002) suggests that it is the combination between internal motivation and structural influences which can result in *"visionary champions"* with a transformation orientation. The typology is built on the assumption that the economic and the sustainability orientation of the entrepreneur are opposites. While our findings are not the first to contradict the existence of this conflict (Bocken, 2015; Weidinger et al., 2014), they do provide additional evidence for the integrated view: the sustainability and the economic orientation are simply two different dimensions. Both extremes, low economic and low sustainability orientation, as well as high economic and high sustainability aspirations can empirically be identified among entrepreneurs.

Zahra et al.'s social entrepreneurs typology (2009) builds on seven dimensions which define three types of social entrepreneurs. The main dimension focuses on the extent to which the societal change the entrepreneur is aspiring to achieve is *structural*. The *"social engineer"* in this model typically challenges existing structures to address social needs. At the same time, this type operates at a very large scale and scope. We can assume that the "social engineer" and the sustainability transformer overlap considerably with respect to both dimensions of our proposed taxonomy for transformative entrepreneurship. By breaking down the aspiration for structural change into two measurable dimensions, we enable empirical identification of *"social engineer"* among startups and thus contribute to the operationalization of the typology developed by Zahra et al.

Our findings also empirically support Hockerts and Wüstenhagen's assumptions about the existence of green *"Davids"* (2010), which are defined as young firms that aim at creating both economic and social/environmental value. This definition is thus very close to the two dimensions suggested by our taxonomy. In addition, their framework suggests that during the early growth-phase, there is a subgroup of startups that differentiate themselves by *particularly* high growth, which ultimately makes them become *"Goliaths."* The authors call this subgroup the *"emerging Davids."* Our findings suggest that the two dimensions of (planned) market impact and priority of environmental and societal sustainability might identify potential transformative *"emerging Davids"* even before their growth becomes factual. An interesting point for future research would be an analysis of driving and limiting factors which influence the path of *sustainability transformers* toward new green "*Goliaths*."

Lastly, it is the two typologies by Schaltegger (2002) and Schaltegger and Wagner (2011)—which the hypotheses of this study were built on—to which our findings can meaningfully contribute. Our empirical analysis has resulted in the first quantitative validation of two central assumptions using a large data set. First, the *positioning matrix for ecopreneurs* (2002) assumes that a categorization of actors is possible by applying two dimensions: *market impact* and *prioritization of environmental goals*. The dimensions of (planned) market impact and priority of environmental and societal impact, adapted for this purpose as well as for the unit of analysis (startups), were empirically validated for the first time based on quantitative data. Second, the *positioning matrix for sustainable entrepreneurship* (2011) assumes that there exists a subgroup of startups that incorporate sustainability as their core business goal and which have an impact on markets and society that reaches beyond their direct customers and stakeholders. Our findings support this assumption and thus the empirical existence of Schaltegger and Wagner's category of "*sustainable entrepreneurship"*: the 9% of startups which we categorize as *sustainability transformers*.

6 | CONCLUSIONS

6.1 | Key findings

While we found several conceptual typologies and taxonomies in the existing literature which differentiate types of green and sustainable entrepreneurs (some of them also referring to the concept of transition/transformation), we identified a clear research gap in terms of empirically grounded taxonomies with an explicit focus on a startup's *transformative capacity* for a transition to sustainability. Consequently, this paper's goal was to generate a taxonomy that categorizes a subcategory of the transformative capacity of a startup: their *transformation orientation* for the multilevel sustainability transition, based on a large quantitative empirical data set. The resulting research question was as follows: Does the transformation orientation differ among startups, and if so, how can they be clustered as basis for sustainability transition policy?

Two hypotheses were developed and subsequently tested:

- H1. Startups can be classified into types that are clearly distinguishable based on their transformation orientation. The latter is expressed by their prioritization of environmental and societal impact and their (planned) market impact.
- H2. There is a clearly distinguishable category of startups that is characterized by a very high transformation orientation. The latter includes both environmental/societal and market impact as a very high priority of a startup.

The data of 1674 German startups was clustered using the two dimensions of *(planned) market impact* and *priority of environmental and societal impact*, which together formed a *taxonomy of transformative entrepreneurship*. The findings confirmed Hypothesis 1 and thus the relevance of the two dimensions suggested in Schaltegger and Wagner's (2011) typology for sustainable entrepreneurship. Six clearly distinguishable clusters were formed based on the empirical data: the *sustainability transformers*, the *biopreneurs*, the *sustainability-sensitive ventures*, the *growth-only ventures*, the *market-focused ventures*, and the *non-growth ventures*.

The results also confirmed Hypothesis 2 and thus the existence of a clearly distinguishable subgroup of hybrid startups with a particularly high transformation orientation: those 9% of startups categorized as *sustainability transformers*. We draw several implications for practice from these findings, presented in the next section.

6.2 | Implications

Our findings have important policy implications. With respect to the multilevel sustainability transition, the empirically derived taxonomy we have created helps to better understand, consider, and promote different types of startups at different stages of the transition and diffusion processes. Until now, the provision of venture capital and public funding schemes for venture growth are not specifically designed and adapted to impact startups (Köhler et al., 2019).

In terms of transition strategies, policymakers can build on our findings to adjust the use of public funds and support programs for startups in favor of the subset of *sustainability transformer* among hybrid startups. In this way, public funds can make use of the strongest potential levers for the sustainability transition and thus achieve the strongest possible effect. In addition, sectoral policies (such as for energy or mobility) can consider the existence of sustainability transformers when designing cooperative projects with, for example, the established industry and when designing public funding schemes as part of energy transition policies.

Our empirical insights are also relevant for public startup support in general. To date, government funding and support programs mostly treat startups as a homogeneous group and follow the assumption that they are essentially pursuing profit- and market-related goals. Our findings suggest that this is not the case. In the future, the design of funding and support programs for startups needs to take a differentiated view and should consider the fact that a substantial number of startups not only follow profit- and market-related goals but also aspire to generate environmental and social impacts. The hybrid character of many startups requires a different approach to startups and an extended portfolio of non-financial support activities such as sustainability-oriented methods and tools for startup coaching and business model development (Breuer et al., 2018), qualification in sustainability assessment of startups (DIN SPEC 90051-1 consortium, 2020; Trautwein, 2021) and training in impact management (Kurz & Kubek, 2016).

6.3 | Limitations

Besides its insights and contributions, this study also has its limitations. First, the analysis is based on self-reported data by startups, which might have caused biases as the statements could not be verified by a third party. Second, the sample only included startups based in Germany, which calls for validation of the results in other countries or regions. Third, the sample focused on startups that are innovative and growth-oriented in terms of the definition applied. For this reason, the sizes of the clusters in the suggested matrix can be assumed to be skewed toward *(planned) market impact*. An analysis of a sample that also includes non-innovative and less-growth-oriented startups might provide interesting insights into the actual distribution of the types over all young ventures.

6.4 | Further research

Further research can build on our findings to provide insights on the potential roles and relevance of different types of startups in the transition process (Geels, 2010; Geels et al., 2016), the diffusion of sustainable products (Hockerts & Wüstenhagen, 2010), or environmental innovation (Clausen & Fichter, 2019; Horne, 2019) as well as in market transformation (Schaltegger et al., 2016). More research is also needed to investigate the entrepreneurial process in more detail and to compare the entrepreneurial goals and objectives—the *orientation* of hybrid startups to generate market and non-market impact with the *actual* outcomes and impacts (Horne, 2019). In this effort, other kinds of evidence and data sources apart from the self-reporting of the startups are needed to be able to assess their transformative potential. The same applies to the comparison between the identified *potential* and the *actual* performance and impacts (Trautwein, 2021). Further research could also contribute to the development of a more nuanced view of the sustainability transformers identified, their characteristics, and support needs (Wagner et al., 2019).

Furthermore, the actor interplay in the market and transformation process and its effects should also be investigated more closely in the future. This concerns both the relationship between new and established companies (Hockerts & Wüstenhagen, 2010) and the relationship between pioneers and laggards within the group of startups. Insights into short- and long-term market and transformation effects

are of great importance here. Lastly, the concepts of transformative capacity, transformation orientation and transformative entrepreneurship introduced in this study need more investigation in regard to the composition of more nuanced constructs, their validation and their role for the sustainability transition.

ACKNOWLEDGEMENTS

The investigation presented in this paper is based on data from the German Green Startup Monitor which was funded by the Deutsche Bundesstiftung Umwelt (German Environment Foundation) as part of the project "Grüne Gründungen als Transformationsmotor stärken (Strengthening green startups as transformation drivers)" (Funding ID 33405/01). We are grateful for the funding and support of the German Environment Foundation. We also thank the anonymous reviewers whose comments have greatly improved the manuscript. Open access funding enabled and organized by Projekt DEAL.

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How to cite this article: Olteanu, Y., & Fichter, K. (2022). Startups as sustainability transformers: A new empirically derived taxonomy and its policy implications. *Business Strategy and the Environment*, *31*(7), 3083–3099. https://doi.org/10.1002/bse.3065