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## RESEARCH ARTICLE

# Identifying business opportunities for sustainable development: Longitudinal and experimental evidence contributing to the field of sustainable entrepreneurship

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## Abstract

Which factors facilitate the identification of business opportunities for sustainable development? To answer this question, we develop a process model of sustainable opportunity identification. We argue that sustainable opportunity identification is a process with transitions from problem to solution identification and from solution to sustainable opportunity identification. Moreover, the transitions are facilitated by two factors—awareness of adverse consequences and entrepreneurial attitude—providing motivation and direction in the process. We tested our model in a field study ( $N = 107$ ) and two experiments ( $N = 53$  and  $N = 69$ ). Our findings show that awareness of adverse consequences and entrepreneurial attitude influence the process of sustainable opportunity identification, explaining under which conditions people are more likely to identify business opportunities for sustainable development. Our study thus contributes to the field of sustainable entrepreneurship.

## KEYWORDS

adverse consequences, awareness, entrepreneurial attitude, motivation, opportunity identification, sustainability

## 1 | INTRODUCTION

People and institutions worldwide acknowledge the numerous challenges the world is facing (United Nations, 2015; World Economic Forum, 2018). Environmental degradation, social inequality, and poverty are only some of the many problems that need global and local solutions. Usually, such ecological and social problems cannot be solved by single actors in isolation but require a system-wide change involving different societal levels and actors (Bolton & Hannon, 2016; Loorbach, van Bakel, Whiteman, & Rotmans, 2010; Wagner, 2009). System-wide changes involve the macrolevel (i.e., societal

trends and developments), the meso-level (i.e., formal and informal institutions), and the microlevel (i.e., actors who identify niches and introduce innovations). A possible pathway leading to system-wide changes is implementing innovations at the microlevel, and an accumulation of such micro initiatives might then change dominant trends, culture, and practices on the macrolevel and meso-level (Loorbach et al., 2010). In this regard, a concept useful to understand how actors identify and introduce innovations is sustainable entrepreneurship (Hall, Daneke, & Lenox, 2010; Schaltegger & Wagner, 2011). Sustainable entrepreneurship deals with “the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring

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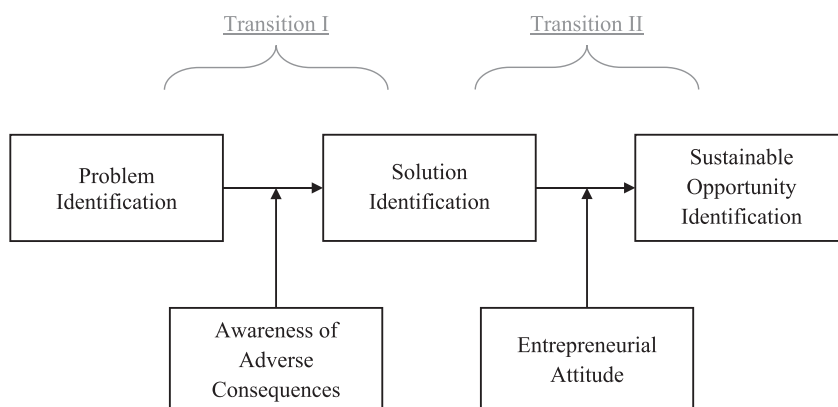
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into existence future products, processes, and services for [...] economic and non-economic gain to individuals, the economy, and society" (Shepherd & Patzelt, 2011, p. 142). Although sustainable entrepreneurship is certainly not a panacea, it can help to address some of the environmental and social problems of our days (Hall et al., 2010).

Given the relevance of sustainable entrepreneurship, researchers have begun to investigate the phenomenon and revealed an important finding: Young adults early in their careers are more likely to engage in sustainable entrepreneurship. The Global Entrepreneurship Monitor conducted a global comparison and found that sustainable entrepreneurship is more prominent among 18- to 34-year old individuals. Moreover, sustainable entrepreneurship is particularly high for individuals with full-secondary and postsecondary education (Bosma & Levie, 2010; Bosma, Schott, Terjesen, & Kew, 2016). Corroborating these findings, research showed that younger adults are more likely to have sustainable entrepreneurial goals than older adults (Vuorio, 2017). The findings indicate that young and well-educated individuals represent the group of people who engage in sustainable entrepreneurship. An example of this group is Carlotta, who we interviewed in the course of this study. Carlotta was an undergraduate student engaged in sustainable entrepreneurship. Together with fellow students, she started a company called 2nd Page to address the problem of paper waste at her university by turning misprints into notepads. Carlotta had observed that "we print so much: essays, scripts, scientific papers, and all the time misprints are just thrown away." Carlotta and her fellow students came up with the idea of reusing the paper even before it gets recycled. "We thought, why not use something that already exists and turn it into something useful." To upcycle the misprints, the team cooperates with a sheltered workshop, where people with disabilities bind new notepads using the misprints. The notepads are sold on campus, exploiting a business opportunity for sustainable development.

In this study, we add to the field of sustainable entrepreneurship by developing a theoretical model to explain the process of how young people early in their careers, like Carlotta, identify business opportunities for sustainable development (Figure 1). We focus on sustainable business opportunities, which are opportunities for the creation of "future goods and services that sustain the natural and/or communal environment and provide development gain for

others" (Patzelt & Shepherd, 2011, p. 632). Further, we focus on the identification of such opportunities because opportunity identification is the starting point of entrepreneurship (Baron, 2007), and thus, a prerequisite for developing innovations that may contribute to transforming societies (Desa, 2012; Venkataraman, 2004). The field of sustainable opportunity identification is still in an early stage, and a single coherent and empirically validated theoretical framework to explain sustainable opportunity identification has not yet emerged (Hanohov & Baldacchino, 2018). We therefore build on and adapt two theoretical models of sustainable opportunity identification, which have been very influential since their publication. Specifically, we build on the process model of sustainable entrepreneurship, which posits that sustainable opportunity identification is a process consisting of transitions from problem to solution and opportunity identification (Belz & Binder, 2017). Additionally, we build on the model of sustainable opportunities recognition, which holds that people must be motivated and directed toward sustainable opportunity identification (Patzelt & Shepherd, 2011). We integrate the model by Belz and Binder (2017) and Patzelt and Shepherd (2011) to explain why young people make the transitions from problem to solution identification and from solution to sustainable opportunity identification. Specifically, we argue that awareness of adverse consequences provides motivation, facilitating the transition from problem to solution identification. Awareness of adverse consequences reflects people's beliefs that environmental conditions pose a threat to humans or other species and objects they value (Stern, 2000). Having such concerns increases people's motivation to generate ideas that help to mitigate this threat. In contrast, people who do not believe that social or environmental problems have adverse consequences are less motivated to generate ideas that help to address these problems. Furthermore, we argue that entrepreneurial attitude provides direction, facilitating the transition from solution to sustainable opportunity identification. Entrepreneurial attitude reflects people's favorable or unfavorable disposition toward entrepreneurship and directs them toward or away from entrepreneurship (Robinson, Stimpson, Huefner, & Hunt, 1991). Accordingly, people with a favorable entrepreneurial attitude are more likely to consider entrepreneurship as a feasible option to implement an identified solution. In contrast, people with an unfavorable entrepreneurial attitude are less likely to think in terms of business opportunities when considering options to implement a



**FIGURE 1** Theoretical model of sustainable opportunity identification among young people at early career stages

solution. For example, a chemist may discover a substance as a substitute for greenhouse gas but is then ignorant about a specific opportunity how to market the substance because of an unfavorable entrepreneurial attitude (Patzelt & Shepherd, 2011). By modeling sustainable opportunity identification as a process consisting of different transitions, we can explain at which stage and whether it is people's motivation or direction hindering the identification of sustainable business opportunities.

To test our model, we conducted a longitudinal study and two experiments. We tested our model in a longitudinal study to capture dynamic aspects in problem, solution, and sustainable opportunity identification as well as in awareness of adverse consequences and entrepreneurial attitude. We then conducted two hybrid between-subject experiments, which combine randomized and quasi-experimental methods (Hsu, Simmons, & Wieland, 2017), to provide evidence for the causal effects of awareness of adverse consequences and entrepreneurial attitude on transitioning through the process of sustainable opportunity identification. The combination of field and experimental studies provides robust evidence for the validity of the theoretical model and answers calls for replication studies (Nosek, Spies, & Motyl, 2012).

Our model comprises transitions from problem to solution and opportunity identification. We follow previous research and conceptualize problem identification as identifying social or ecological deficits (Belz & Binder, 2017; Perrini, Vurro, & Costanzo, 2010), solution identification as identifying ideas to address a social or ecological problem (D. L. Dean, Hender, Rodgers, & Santanen, 2006), and sustainable opportunity identification as identifying products or services that contribute to sustaining the natural or communal environment (Patzelt & Shepherd, 2011). We use the term problem to consider issues that are unwelcome and potentially harmful. By using the everyday term problem, we do not seek to disguise that social and ecological problems are often rooted in complex systems and the consequence of a myriad of structural factors. Similarly, the term solution we use does not imply the complete eradication of a problem (which requires system-wide changes) but refers to ideas that can contribute to addressing the problem. We use the term solution to stay in line with the terminology of the process model of sustainable entrepreneurship (Belz & Binder, 2017). Furthermore, we note that the linear sequence of transitions from problem to solution and opportunity identification is a schematic depiction of the process. The process of opportunity identification oftentimes involves iteratively and recursively refining the opportunity before it matches the needs of the customers (McMullen & Dimov, 2013; Packard, Clark, & Klein, 2017; von Hippel & von Krogh, 2016). The recursive process also comprises leveraging contingencies and receiving feedback from the environment, for example, through networks and collaborations (Brennan & Tennant, 2018; Harmeling & Sarasvathy, 2013; Zucchella & Previtali, 2019). Our model does not preclude such recursive processes and linearly depicts the process to illustrate factors in terms of awareness of adverse consequences and entrepreneurial attitude that facilitate the transitions in the process.

## 2 | THEORY AND HYPOTHESES

### 2.1 | Transitions from problem to solution and sustainable opportunity identification

Based on the process model of sustainable entrepreneurship (Belz & Binder, 2017), we hypothesize that sustainable opportunity identification is a process involving transitions from problem to solution identification and from solution to sustainable opportunity identification. According to the process model, sustainable entrepreneurship starts with the perception of ecological or social problems for which individuals then identify solutions that represent ideas contributing to address the problem. The solutions form the base for identifying sustainable business opportunities. It is important to note that not all solutions necessarily qualify as opportunities in terms of socially valued products or services (Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991; Patzelt & Shepherd, 2011). For example, banning cars from cities to reduce air pollution is technically possible (see for example the city of Oslo, Norway) but does not constitute a product or service (Patzelt & Shepherd, 2011). We argue that identifying multiple ecological or social problems increases the likelihood of coming up with solutions for at least one of the problems. Furthermore, identifying solutions can be described as a stochastic process, implying that with an increasing number of identified problems it becomes more likely that individuals will identify more solutions (Simonton, 1989). Similarly, the greater the pool of identified solutions, the more likely it is that one of the solutions will qualify as a sustainable opportunity. We note that the link between problems and solutions and between solutions and opportunities is of a stochastic and not causal nature. Accordingly, identifying more solutions or opportunities is not a certain consequence of identifying more problems and solutions; yet it happens with a greater likelihood. Our reasoning is supported by research showing that a larger pool of ideas to solve a problem increases the likelihood of identifying a more viable business opportunity (Gielnik, Kramer, Kappel, & Frese, 2014; Gruber, MacMillan, & Thompson, 2008).

**Hypothesis 1.** *The number of identified problems is positively related to the number of identified solutions.*

**Hypothesis 2.** *The number of identified solutions is positively related to the number of identified sustainable opportunities.*

### 2.2 | Awareness of adverse consequences: Facilitating the transition from problem to solution identification

The model of sustainable opportunities recognition posits that perception of threats of the natural or communal environment is a motivational factor affecting sustainable opportunity identification (Patzelt & Shepherd, 2011). Specifically, when people perceive that the environment, including the species living in this environment, is



threatened, they become more motivated to sustain the environment. We use the concept of awareness of adverse consequences to theorize about the perception of threats of the environment because this concept has been widely used to explain sustainable behavior (Stern, 2000). Awareness of adverse consequences is the belief that a valued object, for example, the environment, other species, or humans, is under threat from adverse environmental or social conditions. Awareness of adverse consequences activates an individual's sense of obligation to take action (Stern, 2000). Indeed, research showed that awareness of adverse consequences activated people's motivation to engage in proenvironmental and prosocial action (Stern, Dietz, & Kalof, 1993).

We integrate awareness of adverse consequences as a motivating factor into the process model of sustainable entrepreneurship. Specifically, we hypothesize that awareness of adverse consequences facilitates the transition from problem to solution identification. When people perceive the negative consequences of ecological or social deficits, they tend to be more motivated to generate ideas that help to solve the deficits. Indeed, people were more likely to generate solutions to tackle climate change or unfair payment, when they became aware of the immediate threats posed by these problems (Belz & Binder, 2017). Thus, high awareness of adverse consequences activates people, increasing the likelihood that they identify a solution to a social or ecological problem to prevent the threat. In contrast, people with low awareness of adverse consequences are less likely to transition from problem to solution identification, because they do not perceive the environmental or social problem as a threat. Accordingly, they are less likely to feel obliged to identify a solution to the problem. The facilitating effect of awareness of adverse consequences on transitioning from problem to solution identification can be statistically expressed in a moderation effect (cf., Gielnik, Zacher, & Wang, 2018).

**Hypothesis 3.** *Awareness of adverse consequences moderates the relationship between problem identification and solution identification, such that the higher the awareness of adverse consequences the stronger the relationship is.*

## 2.3 | Entrepreneurial attitude: Facilitating the transition from solution to sustainable opportunity identification

The model of sustainable opportunities recognition holds that an identified solution to a social or ecological problem does not necessarily lead to the identification of a sustainable opportunity. Additional factors need to be considered to understand under which condition people transform solutions into sustainable opportunities. The model of sustainable opportunities recognition holds that entrepreneurial knowledge (e.g., knowledge of markets or customer problems) determines whether people's attention is directed toward entrepreneurship and thus results in sustainable opportunity identification (Patzelt & Shepherd, 2011). We adapt the model of sustainable opportunities

recognition, because of our focus on young people early in their careers, who are less likely to have entrepreneurial knowledge (Gielnik et al., 2018), although they might have a strong entrepreneurial attitude (Athayde, 2009). Entrepreneurial attitude is similar to entrepreneurial knowledge in its function for sustainable opportunity identification, as it guides people's attention (Krosnick, Boninger, Chuang, Berent, & Carnot, 1993; Robinson, Stimpson, Huefner, & Hunt, 1991).

We hypothesize that a strong entrepreneurial attitude increases the likelihood to make the transition from solution to sustainable opportunity identification. Attitudes reflect the positive or negative evaluations of an object and influence people's perceptions and feelings, how they process, retain, and utilize information, and the extent to which they think and talk about an attitude object (Krosnick et al., 1993). A strong entrepreneurial attitude can facilitate the transition from solution to sustainable opportunity identification for two reasons. First, in cases of a strong attitude, the attitude object becomes subject to more frequent thinking and talking (Krosnick et al., 1993). Thinking and talking about an object increase its accessibility, which is the ease with which information about the object can be retrieved (Powell & Fazio, 1984). A higher accessibility increases the sensitivity to situational cues and facilitates the processing of information in accordance with the attitude (Fazio, Powell, & Herr, 1983; Fazio, Sanbonmatsu, Powell, & Kardes, 1986). This suggests that individuals who have a strong entrepreneurial attitude are more likely to consider entrepreneurship when thinking about the implementation of an identified solution. Second, a positive attitude enhances the interest in the object, which results in increased information gathering about the object (Holbrook, Berent, Krosnick, Visser, & Boninger, 2005). Individuals with a favorable entrepreneurial attitude are thus more likely to gather information about entrepreneurship, which increases the likelihood that individuals identify particular features of the identified solutions that can be developed into potential businesses. Hence, sustainable opportunity identification becomes more likely as a result of solution identification when individuals have a strong entrepreneurial attitude.

**Hypothesis 4.** *Entrepreneurial attitude moderates the relationship between solution identification and sustainable opportunity identification, such that the stronger the entrepreneurial attitude the stronger the relationship is.*

## 3 | FIELD STUDY: METHODS

### 3.1 | Sample and procedure

Our sample consisted of 107 participants. We focused on young participants early in their careers who had a college or university background, because research showed that these people are more likely to engage in sustainable entrepreneurship (Bosma et al., 2016). We used a mixed recruitment approach to obtain data from a convenience

sample (Starzyk, Sonnentag, & Albrecht, 2018). We used an information sheet that described the purpose of the study and contained an online link to the study. We posted the information sheet on several social media platforms. Furthermore, we sent the information sheet to our circle of colleagues, family members, and friends. The mixed recruitment approach is justified when the research design requires participants' continuous commitment over several days or weeks (as it was the case in our study). Moreover, the mixed recruitment approach results in a more heterogeneous sample, increasing the generalizability of findings. It is important to note that the mixed recruitment approach does not usually bias study findings (Starzyk et al., 2018). In our sample, the average age was 25 years and 45% were female. Furthermore, 57% were in their bachelor, 21% in their master, 5% were PhD students, and 17% had finished their studies. In our sample, 39% had participated in at least one entrepreneurship course and 65% in at least one sustainability course. Finally, 5% were currently engaged in starting a new venture, and 31% had a self-employed family member.

To test our hypotheses, we used a repeated measurement design. The original English items were translated to German and discussed for meaning with a native English speaker who was also fluent in German. We employed one baseline survey and four weekly surveys. We used the baseline survey to measure our control variables. The weekly surveys assessed the number of identified problems, solutions, and sustainable opportunities, awareness of adverse consequences, and entrepreneurial attitude. We used a design with weekly measurements because previous research revealed a high variability in entrepreneurs' generation of original solutions for problems as well as variation in opportunity identification on a weekly basis (DeTienne & Chandler, 2004; Weinberg, Wach, Stephan, & Wegge, 2018). Our participants received an email with a link to the surveys each week on Wednesdays and a reminder on Fridays and Saturdays. One hundred thirteen participants filled out the baseline survey. To be included in our study, participants had to fill out at least two consecutive weekly surveys to run a lagged analysis (i.e., observations on two consecutive weeks indicated as  $t$  and  $t + 1$  in the tables). Six participants did not meet this requirement. In total, we gathered 424 observations from 107 participants. The lagged design reduced the final number of intraindividual observations to 310, nested within 107 individuals.

## 3.2 | Study measures

### 3.2.1 | Problem identification

We measured problem identification during the weekly measurements. We based our measure of problem identification on the first step in the process model of sustainable entrepreneurship (Belz & Binder, 2017). In the weekly questionnaires, we asked the participants "During the last week how many ecological problems have you identified?" Subsequently, we asked the same question for social problems. We used winsorizing to eliminate extreme responses setting extreme values equal to the value of a certain percentile observation (Kennedy, Lakonishok, & Shaw, 1992). We allowed for six problems per week in

our data analysis, which set values above the 95th percentile to the 95th percentile. For further analysis, we computed the mean score across the two domains of ecological and social problems. The correlation between the two items was  $r = .68$ , computed over the 4 weeks.

### 3.2.2 | Solution identification

We measured solution identification during the weekly measurements. We based our measure of solution identification on the process model of sustainable entrepreneurship (Belz & Binder, 2017). In the weekly questionnaires, we asked the participants how many solutions they have identified for the ecological and social problems. We used winsorizing and allowed for six solutions per week, setting values to the 95th percentile. We computed the mean weekly score for identified ecological and social solutions. The correlation between the two items was  $r = .54$ , computed over the 4 weeks.

### 3.2.3 | Sustainable opportunity identification

We measured sustainable opportunity identification during the weekly measurements based on theoretical conceptualization by Patzelt and Shepherd (2011). In the weekly questionnaires, we asked the participants "During the last week, how many of your solutions seemed promising as a business opportunity in general?" regarding the solutions for ecological and social problems, respectively. We used winsorizing and allowed for three sustainable opportunities per week in our data analysis, setting values to the 95th percentile. We computed the mean weekly score for ecological and social opportunities. The correlation between the two items was  $r = .65$ , computed over the 4 weeks. Asking for the number of identified business opportunities is in line with previous research, which provided support for the criterion validity of the measure. For example, research showed that the self-reported number of identified opportunities predicted business creation (Gielnik et al., 2015). Furthermore, the self-reported number of identified opportunities reflected a choice set, positively influencing the performance of new ventures (Gruber et al., 2008; Gruber, MacMillan, & Thompson, 2013). Similarly, research showed that the number of identified opportunities was positively related to the innovativeness and wealth creation potential of new products and services (Gielnik et al., 2014; Ucbasaran, Westhead, & Wright, 2009).

### 3.2.4 | Awareness of adverse consequences

We measured awareness of adverse consequences during the weekly measurements. The measure was based on the scale by Stern, Dietz, Abel, Guagnano, and Kalof (1999). Subjects rated the severity of two environmental and two societal problems on a 5-point Likert scale ranging from "not a problem" to "a serious problem." The two environmental problems were climate change and toxic substances in air, water, and soil. The two social problems were overpopulation and poverty with growing inequality. The original scale only covers environmental problems. We added two social problems to correspond

with the definition of sustainable behavior, which implies that a person is aware of consequences from environmental and social problems (Corral-Verdugo, Mireles-Acosta, Tapia-Fonllem, & Fraijo-Sing, 2011). An example item was "Do you think climate change is a serious problem, somewhat of a problem or not a problem?" We computed the mean of the four items to attain the participants' individual weekly score for awareness of consequences. Internal consistency was good with Cronbach's alpha being .89, computed over the four weekly surveys.

### 3.2.5 | Entrepreneurial attitude

We measured entrepreneurial attitude during the weekly measurements with four items based on Ajzen (1991). The stem, "To me starting a business is" was rated on a series of 5-point evaluative semantic differential scales with negative and positive endpoints (*harmful-beneficial*, *unpleasant-pleasant*, *bad-good*, *worthless-valuable*). High values were associated with the positive endpoints. The mean across the four items was used as a measure of attitude toward entrepreneurship. Internal consistency was good with Cronbach's alpha being .93, computed over the four weekly surveys.

### 3.2.6 | Controls

All control variables were ascertained in the baseline survey. Participants were asked about their age and gender. We further determined if participants had taken any course on sustainability or entrepreneurship and whether any relatives were self-employed to control for knowledge on sustainability and entrepreneurship. Furthermore, we

controlled for the measurement wave to account for possible trend effects.

### 3.2.7 | Method of analysis

We used a longitudinal lagged design stacking the weekly measurements to use measures of 1 week (indicated as  $t$  in the following tables) to predict values in the subsequent waves (indicated as  $t + 1$ ). For example, we used predictors of Week 1 to predict outcomes in Week 2 and predictors of Week 2 to predict outcomes in Week 3. (Ployhart, Weekley, & Ramsey, 2009). We controlled for the preceding measurement of the dependent variable to model change in the dependent variable. Our dataset consisted of 310 lagged observations, which were derived from the 107 participants over the 4 weeks. Accordingly, the observations were nested within participants, requiring a multilevel approach (Bliese & Ployhart, 2002). We used random coefficient modeling with random intercepts. We tested the moderation effects by including an interaction term of the mean-centered predictor and moderator variables. To interpret the direction of the moderated relationships, we conducted simple slope analyses (Preacher, Curran, & Bauer, 2006). We modeled the interaction effects on the level of the weekly measurements.

## 4 | FIELD STUDY: RESULTS

Table 1 presents the descriptive statistics and correlations. We computed null models to determine the within-person variability of our weekly measures. The results showed that 36% in problem

**TABLE 1** Descriptive statistics and correlations of the field study on Level 2 (baseline) and Level 1 (lagged weekly observations)

Variable	M	SD	1	2	3	4	5	6	7
Level 2									
1. Age	25.18	3.49							
2. Gender <sup>a</sup>	0.55	0.50	.20*						
3. Entrepreneurship course	0.39	0.49	-.17	.22*					
4. Sustainability course	0.65	0.48	-.28**	-.02	.06				
5. Self-employed family member	0.31	0.46	.07	.11	.21*	.02			
Level 1									
1. Time	1.98	0.81							
2. Awareness of adverse consequences ( $t$ )	4.09	0.54	.01						
3. Entrepreneurial attitude ( $t$ )	2.87	0.96	.03	-.01					
4. Problem identification ( $t$ )	2.01	1.69	-.25**	.20**	-.01				
5. Solution identification ( $t$ )	0.97	1.21	-.19**	.20**	.09	.73**			
6. Solution identification ( $t + 1$ )	0.81	1.19	.01	.21**	.02	.59**	.71**		
7. Sustainable opportunity identification ( $t$ )	0.13	0.43	-.10	.09	.25**	.25**	.45**	.32**	
8. Sustainable opportunity identification ( $t + 1$ )	0.08	0.36	-.03	.16**	.15**	.26**	.42**	.45**	.64**

Note.  $N = 107$  (Level 2), number of observations = 310 (Level 1).

<sup>a</sup>0 = female, 1 = male.

\* $p < .05$ . \*\* $p < .01$ .

identification, 35% in solution identification, and 43% in sustainable opportunity identification were within-person variance, suggesting that the participants showed substantial variation in these constructs throughout of the weekly measurements. Furthermore, 20% in awareness of adverse consequences and 15% in entrepreneurial attitude were within-person variance, indicating that these constructs were more stable throughout the study.

#### 4.1 | Test of hypotheses

Hypothesis 1 states that problem identification is positively related to solution identification. Table 2 presents the results. Model 1 includes the control variables. Model 2 shows that problem identification had a positive effect on solution identification ( $B = .14, p = .003$ ), explaining additional 2% of variance in solution identification. The data thus provided support for Hypothesis 1. Hypothesis 2 states that solution identification is positively related to sustainable opportunity identification. Table 3 presents the results. Model 1 includes the control variables. Model 2 shows that solution identification had a positive and significant effect on sustainable opportunity identification ( $B = .04, p = .010$ ), explaining additional 1% of variance in sustainable opportunity identification. The data thus provided support for Hypothesis 2.

Hypothesis 3 states that awareness of adverse consequences moderates the relationship between problem and solution identification. We added the interaction term of awareness of adverse consequences and problem identification in Model 3 of Table 2. The results showed a positive effect of the interaction term on solution

identification ( $B = .15, p = .003$ ), accounting for 2% additional variance explained in solution identification. We conducted simple slope analyses for high and low awareness of adverse consequences (one standard deviation above and below the mean). In case of high awareness of adverse consequences, we found a significant effect ( $B = .20, p < .001$ ), whereas in case of low awareness of consequences, the effect was not significant ( $B = .04, p = .405$ ). The data thus provided support for Hypothesis 3. Figure 2 shows the strength of the relationship between problem and solution identification contingent on awareness of adverse consequences. We calculated the conditional indirect effect of problem identification on sustainable opportunity identification through solution identification contingent on awareness of adverse consequences (Selig & Preacher, 2008). The conditional indirect effect for low awareness of adverse consequences was not significant (indirect effect: 0.002,  $p = .421$ ), whereas the conditional indirect effect was significant for moderate (indirect effect: 0.005,  $p = .012$ ) and high awareness of adverse consequences (indirect effect: 0.008,  $p = .010$ ).

Hypothesis 4 states entrepreneurial attitude moderates the relationship between solution and opportunity identification. We added the interaction term of entrepreneurial attitude and solution identification in Model 3 of Table 3. Model 3 shows that the interaction term between solution identification and entrepreneurial attitude was significant ( $B = .02, p = .047$ ), accounting for 1% of additional variance explained in sustainable opportunity identification. Simple slope analyses revealed that in cases of weak entrepreneurial attitude the effect was not significant ( $B = .02, p = .311$ ), whereas in case of strong entrepreneurial attitude, the effect was significant ( $B = .06, p = .001$ ).

**TABLE 2** Field study results for the transition from problem identification to solution identification

Predictor variables	Solution identification ( $t + 1$ )					
	Model 1		Model 2		Model 3	
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>
Time	0.21**	(0.06)	0.24**	(0.06)	0.22**	(0.06)
Age	0.00	(0.01)	0.00	(0.01)	0.00	(0.01)
Gender <sup>a</sup>	0.07	(0.10)	0.09	(0.10)	0.14	(0.10)
Entrepreneurship course <sup>b</sup>	0.09	(0.10)	0.12	(0.10)	0.12	(0.10)
Sustainability course <sup>b</sup>	0.03	(0.10)	0.05	(0.10)	0.07	(0.10)
Self-employed family member	-0.08	(0.10)	-0.11	(0.10)	-0.13	(0.10)
Solution identification ( $t$ )	0.72**	(0.04)	0.58**	(0.06)	0.55**	(0.06)
Problem identification ( $t$ )			0.14**	(0.04)	0.12**	(0.04)
Awareness of adverse consequences (AC; $t$ )					0.13	(0.09)
Problem identification $\times$ AC ( $t$ )					0.15**	(0.05)
$R^2$ marginal	.53		.55		.57	
$\Delta R^2$ marginal			.02		.02	

Note.  $N = 107$ , Observations = 310 (lagged design).

<sup>a</sup>0 = female, 1 = male.

<sup>b</sup>0 = no, 1 = yes.

\* $p < .05$ . \*\* $p < .01$

**TABLE 3** Field study results for the transition from solution identification to sustainable opportunity identification

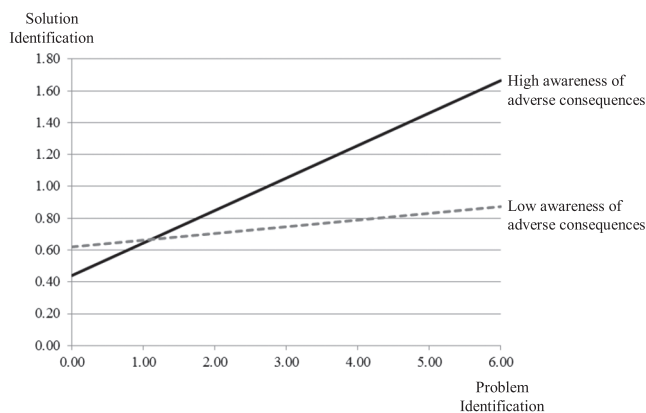
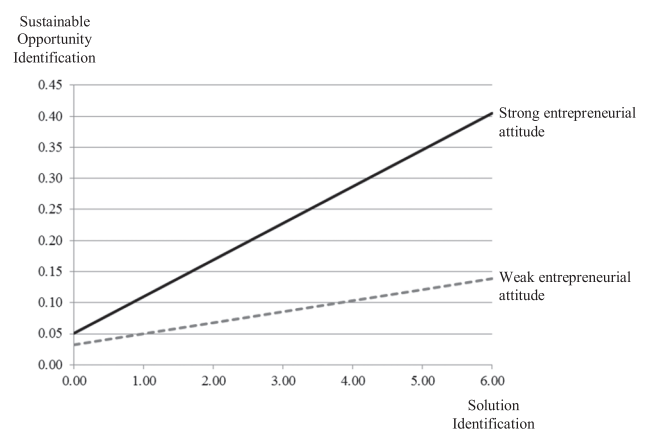
Predictor variables	Sustainable opportunity identification (t + 1)					
	Model 1		Model 2		Model 3	
	B	SE	B	SE	B	SE
Time	−0.01	(0.01)	−0.01	(0.01)	−0.01	(0.01)
Age	0.00	(0.01)	0.00	(0.01)	0.00	(0.01)
Gender <sup>a</sup>	−0.01	(0.07)	−0.02	(0.07)	−0.02	(0.07)
Entrepreneurship course <sup>b</sup>	0.13	(0.07)	0.13	(0.07)	0.11	(0.07)
Sustainability course <sup>b</sup>	0.06	(0.07)	0.05	(0.07)	0.06	(0.07)
Self-employed family member	−0.03	(0.08)	−0.02	(0.07)	−0.02	(0.07)
Sustainable opportunity identification (t)	−0.06	(0.03)	−0.08*	(0.03)	−0.11**	(0.03)
Problem identification (t)	0.02*	(0.01)	0.01	(0.01)	0.01	(0.01)
Solution identification (t)			0.04**	(0.01)	0.04**	(0.01)
Entrepreneurial attitude (EA; t)					0.03	(0.02)
Solution identification × EA (t)					0.02*	(0.01)
R <sup>2</sup> marginal	.04		.05		.06	
ΔR <sup>2</sup> marginal			.01		.01	

Note. N = 107, Observations = 310 (lagged design).

<sup>a</sup>0 = female, 1 = male.

<sup>b</sup>0 = no, 1 = yes.

\**p* < .05. \*\**p* < .01.

**FIGURE 2** The moderation effect of awareness of adverse consequences on the relationship between problem and solution identification in the field study**FIGURE 3** The moderation effect of entrepreneurial attitude on the relationship between solution identification and sustainable opportunity identification in the field study

Hypothesis 4 was thus supported. Figure 3 shows the relationship between solution identification and opportunity identification contingent on entrepreneurial attitude. We computed the conditional indirect effect of problem identification on sustainable opportunity identification through solution identification contingent on entrepreneurial attitude (Selig & Preacher, 2008). The conditional indirect effect for weak entrepreneurial attitude was not significant (indirect effect: 0.002, *p* = .317). The conditional indirect effect was significant for moderate (indirect effect: 0.005, *p* = .008) and strong entrepreneurial attitude (indirect effect: 0.008, *p* = .002).

## 5 | FIELD STUDY: DISCUSSION

In the field study, we examined transitions from problem to solution identification and from solution to sustainable opportunity identification. We found support for the hypotheses that awareness of adverse consequences increases the likelihood of transitioning from problem to solution identification and that entrepreneurial attitude increases the likelihood of transitioning from solution to sustainable opportunity identification. The effects that we found are externally valid, and the lagged design gives a preliminary idea about the causal direction.

**TABLE 4** Descriptive statistics and correlations of Experiment I

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Awareness of adverse consequences manipulation <sup>a</sup>	0.02	1.01										
2. Awareness of consequences before manipulation	5.81	0.66	.12									
3. Awareness of consequences after manipulation	5.82	0.82	.47**	.70**								
4. Problem identification	7.39	2.30	-.14	.16	.02							
5. Solution identification	4.35	1.98	.44**	.16	.13	.35*						
6. Opportunity identification	2.35	1.50	.19	.14	.28*	.40**	.45**					
7. Age	21.91	2.43	-.16	.03	-.02	-.10	-.11	.05				
8. Gender <sup>b</sup>	0.45	0.50	.36**	-.06	.11	-.15	.19	.12	-.01			
9. Entrepreneurship course	0.42	0.50	-.32*	-.01	-.13	.07	-.18	.02	.13	-.07		
10. Sustainability course	0.94	0.23	-.08	.05	.07	.33*	.06	.17	.02	.06	.04	
11. Self-employed family member	0.45	0.50	-.17	-.16	-.15	.18	-.18	-.04	-.03	.09	.00	-.11

Note.  $N = 53$ .

<sup>a</sup>1 = enhanced, -1 = inhibited.

<sup>b</sup>0 = female, 1 = male.

\* $p < .05$ . \*\* $p < .01$ .

However, to provide causal evidence for the moderation effects of awareness of adverse consequences and entrepreneurial attitude we conducted two randomized controlled experiments. We sought to replicate the results of our field study by manipulating the participants' level of awareness of adverse consequences in Experiment I and entrepreneurial attitude in Experiment II.

## 6 | EXPERIMENT I: MANIPULATING AWARENESS OF CONSEQUENCES

### 6.1 | Sample and procedure

In total, 53 bachelor students from a German university participated in the experiment. In the sample, 55% were female. The average age was 22 years. In terms of education, 79% were majoring in Economics and 21% in other fields of study. Of the total sample, 42% had participated in at least one entrepreneurship course, and 94% had participated in at least one sustainability course. Finally, 45% had a self-employed family member.

The experiment included five parts. First, the participants had to complete a questionnaire on their awareness of adverse consequences. Second, we asked them to describe all social and ecological problems that came to their mind. Third, we manipulated participants' awareness of adverse consequences by using the central route to persuasion (Petty & Cacioppo, 1984). We handed out two different articles. In the enhanced condition, the participants read an article about the negative consequences of climate change, toxic substances in air, water, and land, overpopulation and poverty, aimed at increasing the participants' awareness of adverse consequences. The participants of the inhibited condition read an article that simplified and downplayed the same problems and corresponding consequences, aiming at lowering their awareness of adverse consequences. Once the participants

read the article, we asked them to summarize the main points of the text. Fourth, the participants had to think of solutions to the identified problems, giving a short description. This procedure was repeated for the identification of sustainable opportunities. Finally, we asked them to complete a questionnaire on awareness of adverse consequences, which we used for the manipulation check.

### 6.2 | Measures

The measures were identical to those used in the field study, with the exception that we asked the participants to describe all identified problems, solutions, and sustainable opportunities in bullet points. We used these descriptions as our measures for problem identification, solution identification, and sustainable opportunity identification.

#### 6.2.1 | Problem identification

We used a standardized coding scheme to measure problem identification (Mumford, Marks, Connelly, Zaccaro, & Johnson, 1998). Two independent raters coded participants' answers for flexibility. The raters reviewed each participant's responses and assessed the number of different types of problems mentioned that is the number of ecological and social problems that were part of different categories or had a different underlying theme. For example, when a participant wrote down CO<sub>2</sub> emission from passenger cars and CO<sub>2</sub> emission from power plants, the answers would be counted as one problem, namely, air pollution. We used winsorizing to deal with extreme responses. We allowed for a maximum of 10 ecological and 10 social problems, setting values to the 95th percentile. To estimate the interrater reliability between the two raters, we calculated intraclass correlation coefficients (Shrout & Fleiss, 1979). The ICC for ecological and social problems was .93, representing good reliability. Based on

these results, we computed the mean across the two raters for ecological and social problems.

### 6.2.2 | Solution identification

Two independent raters assessed the fluency of participants' responses (Mumford et al., 1998). Fluency is a count measure that captures the number of acceptable responses proposed by the participants to each problem. An acceptable response is a response that addresses the problem and that is not repeated. For example, if a participant wrote down more efficient wind turbines and solar power plants, the responses would be counted as two solutions. We used winsorizing to deal with outliers. We allowed for a maximum of 10 social and 10 ecological solutions, setting values to the 95th percentile. The ICC for ecological and social solutions was .93, representing good reliability.

### 6.2.3 | Sustainable opportunity identification

Two independent raters coded the number of business opportunities based on fluency. For example, upcycling plastic into new pellets and upcycling textiles into new clothes were counted as two business opportunities. We allowed for a maximum of six social and six ecological business opportunities, setting values to the 95th percentile. The ICC for ecological and social opportunities was .91, representing good reliability.

### 6.2.4 | Awareness of adverse consequences

We used the scale by Stern et al. (1999) to measure awareness of adverse consequences. Subjects rated the severity of two environmental and two societal problems on a 5-point Likert scale ranging from "not a problem" to "a serious problem." The two environmental problems were deforestation and toxic substances in air, water, and soil. The two social problems were overpopulation and undernourishment. An example item was "Do you think deforestation is a serious problem, somewhat of a problem or not a problem?" We computed the mean of the four items to attain the participants' individual scores for awareness of consequences before and after the experiment. Cronbach's alpha showed satisfactory internal consistency for awareness of adverse consequences (.64).

## 7 | RESULTS

Table 4 provides the descriptive statistics and correlations. We conducted *t* tests as manipulation checks using the measures of awareness of adverse consequences before and after the experimental manipulation. The *t* test before the experiment showed no significant difference between the enhanced ( $M = 5.89$ ) and inhibited condition ( $M = 5.73$ ,  $t = 0.87$ ,  $p = .388$ ). The result for the *t* test after the experiment showed a significant difference in awareness of adverse consequences between the enhanced ( $M = 6.19$ ) and inhibited condition

( $M = 5.43$ ,  $t = 3.79$ ,  $p < .001$ ), providing evidence for the successful manipulation. To test if the randomization was successful, we conducted independent *t* tests for the control variables of age, gender, self-employed family member, and participation in an entrepreneurship and sustainability course. The results showed a significant difference for gender in the enhanced ( $M = 0.63$ ) and the inhibited condition ( $M = 0.27$ ,  $t = 2.78$ ,  $p = .008$ ) and for participation in an entrepreneurship course in the enhanced condition ( $M = 0.26$ ) and the inhibited condition ( $M = 0.58$ ,  $t = 2.43$ ,  $p = .019$ ). All other variables were randomized successfully.

We carried out two separate regression analyses to test Hypotheses 1 and 2. Table 5 displays the results. Model 1 shows that problem identification had a positive effect on solution identification ( $B = 0.43$ ,  $p < .001$ ), and Model 3 shows that solution identification had a positive effect on sustainable opportunity identification ( $B = 0.26$ ,  $p = .025$ ). The data thus provided support for Hypotheses 1 and 2.

Hypothesis 3 states that awareness of adverse consequences moderates the relationship between problem and solution identification. The results in Model 2 show a significant interaction effect between problem identification and the experimental condition ( $B = 0.23$ ,  $p = .024$ ), accounting for 17% of additional variance explained in solution identification. Simple slope analyses revealed that problem identification had a significant effect on solution identification in case of enhanced awareness of adverse consequences ( $B = 0.65$ ,  $p < .001$ ). The effect was not significant in the case of inhibited awareness of adverse consequences ( $B = 0.19$ ,  $p = .204$ ). The data thus provided support for Hypothesis 3. Because the randomization check revealed a significant difference for gender and participation in an entrepreneurship course, we conducted a robustness check by adding the interaction terms for problem identification and gender as well as problem identification and participation in an entrepreneurship course to the regression analysis (not displayed in Table 5). The results showed that the interaction between problem identification and the experimental condition remained significant ( $B = 0.26$ ,  $p = .043$ ), whereas the interaction terms for problem identification and gender ( $B = -0.07$ ,  $p = .751$ ) and problem identification and participation in an entrepreneurship course were not significant ( $B = 0.10$ ,  $p = .729$ ).

## 8 | EXPERIMENT II: MANIPULATING ENTREPRENEURIAL ATTITUDE

### 8.1 | Sample and procedure

In total, 70 students participated in the experiment. We had to exclude one participant due to incomplete responses. In the sample, 68% were female. The average age was 23 years. In terms of education, 28% were majoring in Economics, 26% in Business Psychology, 11% in teaching, 10% in sustainability and cultural studies, and 25% in other fields. The sample consisted of 47 bachelor students, 14 master students, and 8 otherwise enrolled students. Of the total sample, 29% had participated in at least one entrepreneurship course, and

**TABLE 5** Results for Experiment I: Manipulating awareness of adverse consequences

Predictor variables	Solution identification				Sustainable opportunity identification	
	Model 1		Model 2		Model 3	
	B	SE	B	SE	B	SE
Age	−0.03	(0.10)	0.00	(0.09)	0.07	(0.08)
Gender <sup>a</sup>	1.10*	(0.50)	0.74	(0.48)	0.30	(0.40)
Entrepreneurship course	−0.72	(0.49)	−0.17	(0.46)	0.17	(0.39)
Sustainability course	−1.19	(1.13)	−1.30	(1.03)	0.23	(0.88)
Self-employed family member	−1.22*	(0.50)	−0.92	(0.46)	−0.08	(0.41)
Problem Identification	0.43**	(0.12)	0.42**	(0.10)	0.19	(0.10)
Awareness of adverse consequences manipulation (AC) <sup>b</sup>			0.72**	(0.25)		
Problem identification × AC			0.23*	(0.10)		
Solution identification					0.26**	(0.11)
R <sup>2</sup>	0.31		0.48		0.30	
ΔR <sup>2</sup>			0.17			
F	3.44**		5.09**		2.76*	

Note. Number of participants = 53.

<sup>a</sup>0 = female, 1 = male.

<sup>b</sup>1 = enhanced, −1 = inhibited.

\* $p < .05$ . \*\* $p < .01$ .

**TABLE 6** Descriptive statistics and correlations of Experiment II

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Entrepreneurial attitude manipulation <sup>a</sup>	−0.04	1.01										
2. Entrepreneurial attitude before manipulation	2.86	0.93	.19									
3. Entrepreneurial attitude after manipulation	2.83	0.98	.25*	.94**								
4. Problem identification	4.08	2.22	.01	.17	.16							
5. Solution identification	2.79	2.03	.23	.10	.14	.67**						
6. Opportunity identification	0.97	1.27	.29*	.03	.13	.49**	.72**					
7. Age	22.90	3.46	.10	.16	.14	.01	.05	.00				
8. Gender <sup>b</sup>	0.32	0.47	.15	.09	.11	−.11	−.06	−.07	.10			
9. Entrepreneurship course	0.29	0.46	.03	.21	.27*	.25*	.31**	.23	.13	−.03		
10. Sustainability course	0.65	0.48	.27*	.22	.18	.37**	.26*	.26*	−.20	−.02	.20	
11. Self-employed family member	0.32	0.47	.03	.16	.13	−.02	−.04	.04	−.04	.00	.04	.04

Note. N = 69.

<sup>a</sup>1 = enhanced, −1 = inhibited.

<sup>b</sup>0 = female, 1 = male.

\* $p < .05$ . \*\* $p < .01$ .

65% had participated in at least one sustainability course. Finally, 32% had a self-employed family member. None of the participants was currently engaged in starting a new venture.

The experiment included seven parts. First, the participants had to complete a questionnaire on their entrepreneurial attitude. Second, the participants had to describe all social and ecological problems that

came to their mind. In step three, we began manipulating participants' entrepreneurial attitudes using two assignments. In assignment one, the participants in the enhanced entrepreneurial attitude condition read an article about the benefits of being self-employed, whereas the participants of the inhibited entrepreneurial attitude condition read an article about the detriments of being self-employed. We based



this manipulation on the central route to persuasion, which assumes that the number and quality of arguments in a message increase its persuasive impact by providing more information thus increasing favorable issue-relevant thoughts (Petty & Cacioppo, 1984). In the enhanced entrepreneurial condition, we presented six positive consequences of being self-employed (e.g., higher job satisfaction). In the inhibited entrepreneurial attitude condition, we presented six negative consequences of self-employment (e.g., higher levels of stress). Fourth, after the first assignment, the participants had to think of solutions to the identified problems in part two. The participants had to give a short description. Fifth, we conducted the second assignment to manipulate entrepreneurial attitude, which was based on the persuasion-from-within approach (McGuire & McGuire, 1996). This approach aims at manipulating the salience of an attitude by giving the subject a directed-thinking task. We asked the participants to write down as many desirable or undesirable consequences of being self-employed as they could think of. The persuasion-from-within approach suggests that the directed-thinking task affects participants' attitude toward self-employment positively or negatively when generating favorable or unfavorable consequences. Sixth, the participants had to write down the solutions that qualified as sustainable opportunities and to describe them. Lastly, we measured participants' entrepreneurial attitudes, which we used for the manipulation check.

## 8.2 | Measures

We used two independent raters and the same standardized coding scheme as in Experiment I to code problem, solution, and sustainable opportunity identification. We used winsorizing to deal with outliers. We allowed for a maximum value of 10 ecological and social problems and solutions as well as a maximum of six social and ecological opportunities, setting values to the 95th percentile. To estimate the interrater reliability, we calculated intraclass correlation coefficients. The ICCs were good with values of .97 for problem identification, .97 for solution identification, and .99 for sustainable opportunity identification. We used five items to measure entrepreneurial attitude (Ajzen, 1991). The stem "To me starting a business is" was rated on 5-point evaluative semantic differential scales with negative and positive endpoints (e.g., *useless-worthwhile*). Cronbach's alpha showed good internal consistency (.91).

## 8.3 | Results

Table 6 provides the descriptive statistics and correlations. We conducted *t* tests to compare entrepreneurial attitude in the enhanced and inhibited condition before and after the manipulation. We did not find a significant difference between the enhanced ( $M = 3.04$ ) and inhibited condition ( $M = 2.70$ ,  $t = 1.56$ ,  $p = .124$ ) before the manipulation. We found a significant difference between the enhanced ( $M = 3.08$ ) and inhibited conditions ( $M = 2.59$ ,  $t = 2.10$ ,  $p = .039$ ) after the experimental manipulation, providing evidence for the successful manipulation. To test if the randomization was successful, we

conducted *t* tests for the control variables. The results showed a significant difference in participation in a sustainability course between the enhanced condition ( $M = 0.79$ ) and the inhibited condition ( $M = 0.53$ ,  $t = 2.34$ ,  $p = .022$ ). For all other variables, the randomization was successful.

To test Hypotheses 1 and 2, we carried out two separate regression analyses. Table 7 displays the result. Model 1 shows that problem identification had a positive effect on solution identification ( $B = 0.57$ ,  $p < .001$ ). Model 2 shows that solution identification had a positive effect on sustainable opportunity identification ( $B = 0.45$ ,  $p < .001$ ). The data thus provided support for Hypothesis 1 and 2.

Hypothesis 4 states that entrepreneurial attitude moderates the relationship between solution and opportunity identification. The results in Model 3 show a significant interaction effect between solution identification and the experimental condition ( $B = 0.22$ ,  $p < .001$ ). The interaction effect explained 12% additional variance in sustainable opportunity identification. We conducted simple slope analyses for the enhanced and inhibited entrepreneurial attitude condition. The analysis revealed that in cases of enhanced entrepreneurial attitude, the effect was significant ( $B = 0.62$ ,  $p < .001$ ). The effect was weaker in case of inhibited entrepreneurial attitude ( $B = 0.19$ ,  $p = .037$ ). The data thus provided support for Hypothesis 4.

The randomization check revealed a significant difference for participation in a sustainability course. We therefore, conducted a robustness check by adding a second interaction term between solution identification and participation in a sustainability course to the regression analysis (not displayed in Table 7). The results showed that the interaction between solution identification and entrepreneurial attitude remained significant ( $B = 0.20$ ,  $p < .001$ ) when controlling for the interaction term between solution identification and participation in a sustainability course in the model ( $B = 0.22$ ,  $p = .096$ ).

## 9 | OVERALL DISCUSSION

Current ecological and social problems have multiple causes that are embedded in a wide range of societal levels and actors (Loorbach et al., 2010). Addressing these problems requires a system-wide structural change across different institutional levels, such as policy, economy, society, and organizations. A factor that can contribute to addressing the problems is agency by entrepreneurs and other actors to change dominant practices and mindsets (Bolton & Hannon, 2016; De Clercq & Voronov, 2011; Stephan, Uhlaner, & Stride, 2015). Accordingly, it is possible to argue that entrepreneurs and sustainability entrepreneurship could play an important role in the pursuit of sustainability, without underestimating or neglecting the necessity of a systemic approach, networks, and collaborative efforts to deal with the complexities of many ecological and social problems. Unfortunately, the field of sustainable entrepreneurship is still in a nascent stage (Belz & Binder, 2017; Munoz & Cohen, 2018). We aimed at contributing to the field of sustainable entrepreneurship by testing a model of the identification of business opportunities for sustainable development. We believe our study contributes to the literature in several ways.

**TABLE 7** Results for Experiment II: Manipulating entrepreneurial attitude

Predictor variables	Solution identification		Sustainable opportunity identification			
	Model 1		Model 2		Model 3	
	B	SE	B	SE	B	SE
Age	0.02	(0.06)	−0.01	(0.03)	−0.01	(0.03)
Gender <sup>a</sup>	0.02	(0.40)	−0.06	(0.24)	−0.08	(0.21)
Entrepreneurship course	0.65	(0.43)	−0.01	(0.26)	−0.14	(0.23)
Sustainability course	0.04	(0.44)	0.20	(0.26)	0.17	(0.24)
Self-employed family member	−0.16	(0.40)	0.17	(0.24)	0.13	(0.21)
Problem identification	0.57**	(0.09)	−0.01	(0.07)	0.02	(0.06)
Solution identification			0.45**	(0.08)	0.40**	(0.07)
Entrepreneurial attitude manipulation (EA) <sup>b</sup>					0.17	(0.11)
Solution identification × EA					0.22**	(0.05)
R <sup>2</sup>	0.47		0.54		0.66	
ΔR <sup>2</sup>					0.12	
F	9.07**		10.04**		12.73**	

Note. Number of participants = 69.

<sup>a</sup>0 = female, 1 = male.

<sup>b</sup>1 = enhanced, −1 = inhibited.

\* $p < .05$ . \*\* $p < .01$ .

## 9.1 | Theoretical and practical implications

We contribute to the field of sustainable entrepreneurship by providing a theoretical integration of two prominent models to explain the identification of business opportunities for sustainable development. Specifically, we integrated the model by Belz and Binder (2017) and Patzelt and Shepherd (2011) to explain the process of transitioning from problem to solution identification and from solution to sustainable opportunity identification. By modeling sustainable opportunity identification as a process consisting of different transitions, our model can explain at which stage and whether it is people's motivation or direction preventing them from identifying sustainable business opportunities. We showed that awareness of adverse consequences facilitates the first transition and entrepreneurial attitude facilitates the second transition. Accordingly, our findings show why and under which conditions people are more likely to transition through the process of sustainable opportunity identification, advancing our understanding of how the process of sustainable opportunity identification unfolds on the individual (micro) level. Our study complements previous work that has offered important insights on system-level factors promoting or inhibiting sustainable entrepreneurship (Cohen & Winn, 2007; T. J. Dean & McMullen, 2007; Meek, Pacheco, & York, 2010) as well as studies on the individual level that have mostly adopted a case study approach (Belz & Binder, 2017; Choi & Gray, 2008; Corner & Ho, 2010; Hanohov & Baldacchino, 2018; Perrini et al., 2010).

Our theoretical model can serve as a starting point for future research seeking to identify factors that facilitate transitioning

through the process of sustainable opportunity identification. We showed that awareness of adverse consequences and entrepreneurial attitude facilitate the transitions in the process. Thus, factors less specific to entrepreneurship, such as awareness of adverse consequences, are also relevant to understand people's entrepreneurial behavior. By disentangling the opportunity identification process into three steps with two transitions, we demonstrate how factors specific and unspecific to entrepreneurship (entrepreneurial attitude and awareness of adverse consequences) help to gain a deeper understanding of how people's early entrepreneurial behavior might be guided into the direction of sustainable entrepreneurship. Future research could examine additional factors specific and unspecific to entrepreneurship that provide motivation and direction toward sustainability entrepreneurship. For example, previous research suggested that important factors motivating people to engage with environmental and social issues are their values and belief systems (Revell, Stokes, & Chen, 2010; Wijethilake & Lama, 2019; Williams & Schaefer, 2013). Specifically, people's sustainability orientation, empathy, altruism, and proenvironmental or prosocial attitude could be relevant constructs in this regard (Bissing-Olson, Iyer, Fielding, & Zacher, 2013; Grant & Berry, 2011; Hockerts, 2017; Kuckertz & Wagner, 2010; Revell et al., 2010). Similarly, activism, self-help, and philanthropy could be reasons motivating people to search for solutions to address persistent sustainability issues (Hockerts, 2006). Furthermore, people's general or social entrepreneurial intentions, financial rewards, and contingencies are factors that could be relevant in directing people toward the identification of sustainable business opportunities (Harmeling & Sarasvathy, 2013; Hockerts, 2017; Kuckertz & Wagner, 2010; Shepherd & DeTienne, 2005). In

contrast, a lack of resources, capital, or expertise could be barriers preventing people from engaging in sustainability entrepreneurship (Alvarez Jamarillo, Zartha Sossa, & Orozco Mendoza, 2019). Future research could examine these constructs and build on our theoretical model to advance our understanding of factors facilitating the transitions in the process of sustainable opportunity identification.

Finally, our study answers the call to provide practical implications of how to change and facilitate people's actions concerning sustainable entrepreneurship (Shepherd & Patzelt, 2011; Westman et al., 2019). Our study provides empirical evidence for the importance of awareness of adverse consequences and entrepreneurial attitude for sustainable opportunity identification. As opportunities constitute the first step in the entrepreneurial process, actors and institutions can use our findings as a starting point for designing more effective interventions. Entrepreneurship education could incorporate lessons that increase awareness of adverse consequences to change peoples' perception of social and ecological problems with the aim to identify more solutions. Additionally, entrepreneurship education could consider incorporating inoculation procedures to prevent a deactivation of people's awareness of adverse consequences as a consequence of anti-environmentalist rhetoric or fake news (Lazer et al., 2018; Stern, 2000). Further, programs could foster participants' entrepreneurial attitudes to increase the likelihood that people consider entrepreneurship as a potential means for implementing an identified solution.

## 9.2 | Strengths and limitations

One limitation of our field study is that we relied on self-reported and individual-level data in weekly retrospective reports, which may have caused different biases. Self-reported data may be subject to different response biases such as the tendency to respond in socially desirable ways (Donaldson & Grant-Vallone, 2002). Sustainable topics such as environmental protection are seen as collectively desirable but possibly conflicting with individual goals and convenience (Karp, 1996). Thus, participants may over report on their awareness of adverse consequences because it is socially desirable. However, when designing the questionnaire, we took steps to minimize a social desirability response bias. To ensure anonymity, the questionnaire was carried out online, and participants were assured that their names would not be associated with the findings. Moreover, in our experiments, we were able to replicate the findings of our field study.

We used samples of young adults early in their careers, which might prevent drawing conclusions to a broader range of the population. Furthermore, we used student samples for our experiments. However, such a sample may still be appropriate for our study of sustainable opportunity identification, because sustainable entrepreneurship is a prevalent phenomenon for highly educated 18- to 34-year-olds (Bosma et al., 2016; Bosma & Levie, 2010). These findings are further supported by studies that provide evidence that individuals with higher levels of education are more likely to become self-employed (Unger, Rauch, Frese, & Rosenbusch, 2011).

Our theoretical model suggests a process from problem to solution identification. This direction corresponds to standard models of problem-solving and opportunity identification (Belz & Binder, 2017; Mumford et al., 1991). We note, however, that in some instances, identifying a solution precedes identifying a problem (von Hippel & von Krogh, 2016). People may identify need-solution pairs that they can commercialize without prior identification of a problem. Furthermore, we note that our measure of solution identification does not distinguish between a high number of solutions for one or many different problems. Identifying solutions for many problems might lead to a larger variety of solutions and opportunities, resulting in performance benefits for the new venture (Gielnik, Frese, Graf, & Kampschulte, 2012; Gruber et al., 2013).

A strength is the research design combining a field study with two experiments to augment the external and internal validity of our study. We conducted the field study with repeated measurements in a natural setting, addressing issues of external validity. We replicated the findings using randomized controlled experiments, addressing issues of internal validity. The experimental setting allowed us to demonstrate the internal validity of our findings and to draw causal conclusions regarding the facilitating function of awareness of adverse consequences and entrepreneurial attitude in the process of sustainable opportunity identification (Campbell, 1957).

## 9.3 | Conclusion

We tested a process model to examine how young adults identify sustainable opportunities. In the process, individuals with high awareness of adverse consequences were more likely to transition from problem to solution identification. Furthermore, individuals with a strong entrepreneurial attitude were more likely to transition from solution to sustainable opportunity identification. Thus, the joint examination of awareness of adverse consequences and entrepreneurial attitude in the process leading from problems to sustainable opportunities through solutions provides a more comprehensive picture of sustainable opportunity identification.

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