

RESEARCH ARTICLE

Exploring New Venture Idea Development with External Enablers and Design Process in Nascent Entrepreneurs

Triyuth Promsiri, Krisakorn Sukavejworakit, and Thanaphol Virasa

Mahidol University, Thailand

triyuth.p@gmail.com

Abstract: As the world is transforming towards the value-based economy, viable new venture idea is recognized as the antecedent of all entrepreneurial activities that drive economic growth. This paper aims to provide a deeper understanding of new venture idea development by exploring the constructs of external enablers and the design process through the science of design theory. To explore the effect of external enablers and design processes on the generation of new venture ideas, two experiments were carried out in the format of a new venture idea challenge. The first experiment was conducted with 120 undergraduate students to test the effects of an external enabler and the design process on new venture idea generation. The second experiment was conducted with 15 graduate students to test the effects of different technological external enablers on new venture idea development. The findings suggest that external enablers mainly affect the quality of new venture ideas, and design processes mainly affect the number of new venture ideas. With the application of a design process, external enablers had a more positive effect on the quantity and quality of new venture ideas. This study extends the theoretical explanation of the entrepreneurial process by applying the science of design to examine the transformation of opportunities into new venture ideas. With this research design, researchers can test the effects of objective phenomena and subjective conjecture through the design process instruments to measure new venture ideas. This study can also be applied in entrepreneurial classroom activities, and to the idea generation process of novice entrepreneurs.

Keywords: external enabler, idea development, idea opportunity creation, new venture, science of design

New venture idea development has been recognized as one of the most important stages in the entrepreneurial process (Davidsson & Tonelli, 2013; Shane, 2003), and has consequently become an important element in the scholarly study of entrepreneurship. Davidsson and Tonelli (2013) contended that “new venture ideas are separate entities that can explain actions and outcomes in the entrepreneurial process” (p. 8). Recent

research into the opportunity creation and discovery theories have extended its boundaries to include new venture idea development as a key element of the entrepreneurial process (Alvarez, Barney, & Anderson, 2012; Davidsson & Tonelli, 2013; Eckhardt & Shane, 2013). There has been considerable interest in how some people are able to develop feasible new venture ideas, while others cannot or do not.

Recent conceptual studies have explained and characterized the concept of new venture ideas (Davidsson & Tonelli, 2013; Davidsson, 2015; Hill & Birkinshaw, 2010), but little research has empirically explored the effect of *objective phenomena* and a cognitive mechanism on new venture idea development. Previous studies, such as Baron (2006), provide some explanation of the cognitive mechanism. The understanding of new venture idea development in the opportunity theory is limited to understanding the cognitive mechanism applied in the new venture idea development process. There is no notable research specifically explaining the cognitive mechanism that entrepreneurs use to transform objective phenomena into a new venture idea. The theory needs more research to explain which cognitive mechanism individuals use to transform objective phenomena into a new venture idea (Shane, 2012).

While the understanding of new venture idea development in the discovery theory is limited, “the science of the artificial” has been proposed as an alternative way of explaining how entrepreneurs transform objective phenomena into a new venture idea (Sarasvathy, 2003). While normal science focuses on the study of nature and natural phenomena, the premise of the science of the artificial focuses on the logic of human artifacts (Simon, 1969). Studying entrepreneurship as a science of the artificial theorizes that the outer environment (or objective phenomena) constrains, but does not dictate, the inner environment (or subjective conjecture; Venkataraman, Sarasvathy, Dew & Forster, 2012). By applying the design’s theory, an opportunity construct can be exemplified by justifying it as an artifact (objective) which stimulates the creation of a new venture idea (subjective). In this study, we explore the effect of objective phenomena or the outer environment on new venture idea development by using the design process as the cognitive mechanism to gain a deeper understanding of new venture idea development.

Another issue central to the study of the discovery theory is how opportunities and ideas are measured and, therefore, empirically tested. Past empirical research on the discovery theory has focused on the variety and quantity of opportunities (ideas) identified as dependent variables (Corbett, 2002; Shepherd & De

Tienne, 2005; Singh, Hills, Lumpkin & Hybels, 1999). While the number of opportunities (ideas) identified is an appropriate outcome of the entrepreneurial process, it may not be a sufficient indicator of the value of those ideas. The terms “opportunity” and “idea” are also used interchangeably, whereby opportunity in the discovery theory is viewed as a situational change. To distinguish opportunity from new venture idea, Davidsson (2015) suggested external enablers as objective phenomena in the entrepreneurial process.

Consequently, in this research, we explore the effect of objective phenomena or external enablers and the design process on both the number and content of new venture ideas. To explore this relationship, we conducted an experimental study examining whether external enablers have a positive effect on new venture ideas, whether the design process has a positive effect on new venture ideas, and whether external enablers and the design process have a positive effect on new venture ideas.

The paper proceeds as follows. First, we use research based upon the discovery theory and the sciences of the artificial to highlight how objective phenomena or external enablers impact new venture idea development and the role of the design process in the development of new venture ideas. Second, based on research from new venture creation literature and design process literature, we discuss how external enablers impact new venture idea development. Third, we discuss the inter-relationship among the variables and hypothesize that the relationship between external enablers and new venture idea development is affected by the design process. Fourth, we describe the research method and the results. Finally, we discuss the findings.

Literature Review

New Venture Idea Development

Creating new ideas lies at the heart of entrepreneurship as entrepreneurs are the ones who create new combinations (Schumpeter, 1961), in the form of a new range of business offerings, for example, a product or service, market, technology, production method, or business model. The terminology related to new venture ideas in entrepreneurship first appeared in entrepreneurship research and was referred to

in the studies related to new products and services (Bird, 1988). Later, the concept of new venture ideas was proposed in the theoretical literature related to entrepreneurial opportunities. The notion of a new venture idea has been considered by entrepreneurship scholars as a more workable construct (Davidsson & Tonelli, 2013). It is a cognitive construct reflecting what the actor is considering or aiming to create, and clearly subjective.

In the opportunity creation theory, a new venture idea is generally referred to the production of the imagination and resourced combinations (Alvarez & Barney, 2007; Sarasvathy, Dew, Velamuri, & Venkataraman, 2003). The opportunity development theory (Ardichvili, Cardozo, & Ray, 2003) suggests that a new venture idea is the first outcome of the opportunity development process and that it could later evolve into a business concept, business model, and business plan. In the opportunity discovery theory, a new venture idea exists as the subjective conjecture of individuals. It is the outcome of the entrepreneurial process which has the objective phenomena or entrepreneurial opportunity as the antecedent of the process (Shane & Venkataraman, 2000; Eckhardt & Shane, 2013).

Most research in the discovery theory has focused only on the opportunity recognition stage (e.g., Baron, 2006; Arenius & De Clercq, 2005; Lumpkin & Lichtenstein, 2005; Gregoire, Shepherd, & Lambert, 2010), while the mechanism used to transform objective phenomena into new venture ideas has not been fully explained. According to Shane (2012), there is a need for an additional explanation of new venture idea development in the opportunity discovery theory.

External Enablers

There is a broad agreement that external forces such as technological advancement, regulatory changes, demographic trends, and changes to the socio-economic, political, and natural environment strongly influence entrepreneurial action (Alvarez & Barney, 2013; Dimov, 2011; Shane, 2012). In the discovery theory, Shane and Venkataraman (2000) portrayed such factors as sources of entrepreneurial opportunities. Davidsson (2015) conceptually

separated salient external factors from complex notions of entrepreneurial opportunities and defined such factors as external enablers.

According to the definition of Davidsson (2015, p. 683), external enablers are “distinct, external circumstance(s)” that have “the potential of playing an essential role in eliciting and/or enabling a variety of entrepreneurial endeavors by several (potential) actors.” Changes in technologies, demographics, regulatory frameworks, and the natural environment are enabling factors that significantly influence entrepreneurial action and success (Alvarez & Barney, 2013; Dimov, 2011; Shane, 2012). External enablers are also aggregate-level phenomena and temporary, as their enabling powers either decrease over time as a result of being exploited or disappear through further technological advancement. For instance, with the boom of the Internet in the 1990s, a significant increase was reported in the number of new venture ideas and new web-based ventures creation. However, after the dotcom crash in the year 2000, many web-based computer businesses disappeared as a result of the benefits of the Internet being exploited and further technological advancements in mobile technology and its applications.

Design Process

The concept of the design process has gained more interest from scholars in the past decade, such as in the study of design thinking and business model generation (Osterwalder, 2004). The design process provides a sequence of heuristic activities that usually consist of analysis, evaluation, refinement, and development. It consists of all stages involved in idea development, including creation, assessment, selection, and the production of ideas. The design process integrates technical feasibility, economic value, and customer needs (Plattner, Meinel & Weinberg, 2009). According to Jones (1970), the design process consists of three stages, which are (1) divergence, (2) transformation, and (3) convergence. In these three stages, both creativity and critical thinking are applied to create viable ideas.

Another related theory on the design process is the theory of meaning for artifacts, which was developed by Krippendorff and Butler (2008). This theory was

built on the human-centered approach design theory. The idea of the theory is to illustrate not only that individuals understand and interpret objects in physical terms, but also how they communicate and interact with them. This idea supports the research of Venkataraman et al. (2012), who concluded that entrepreneurial opportunity could be defined as something inter-subjective that requires the perception of physical, social, and cognitive elements. The science of design focuses more on the method, procedure, and process of creating the artifacts.

While there are a number of design processes, in this study, we are interested in the design process that helps individuals generate ideas from artifacts. Hence, we adopted the product design process to study new venture idea development. According to Hsiao and Chou (2004), product design process is usually applied in the early phases of business creation, which includes a complex set of integrated efforts such as generating ideas, developing concepts, and evaluating proper solutions.

External Enablers and New Venture Idea Development

With a realistic perspective, opportunity in the discovery theory refers to the objective phenomena that is derive from *situational change*. The concept of situational change can be described as exogenous shocks, which refer to the disruptive changes in an

industry or a market (Schumpeter, 1934). The sources of change can be social, political, regulatory, legal, or technological (Eckhardt & Shane, 2003). These changes create opportunities for entrepreneurs to enter the market by introducing new values to better serve the current market.

To investigate the relationship between entrepreneurial opportunity and ideas in the discovery theory, Davidsson (2015) suggested three new constructs to represent an entrepreneurial opportunity: (1) external enablers, (2) new venture ideas, and (3) opportunity confidence. An external enabler is defined as the external circumstance that affects the supply and demand structure. This is in line with the idea of previous studies which state that the external environment affects new venture (Alvarez & Barney, 2013; Dimov, 2011; Shane, 2012).

In addition, previous studies support the idea that situational change affects new venture creation. Shane (2001) found that technological changes affect the number of new firms being formed (or the quantity of venture creation). By using 3D printing as a case study, Shane (2003) suggested that new technology results in more opportunities (or business ideas). Corbett's (2007) research used the radio wave as the situational change that created a number of opportunities (or ideas). Therefore, it appears that situational change or external enablers can enhance an individual's ability to generate both the number and the content of ideas.

Theoretical Framework

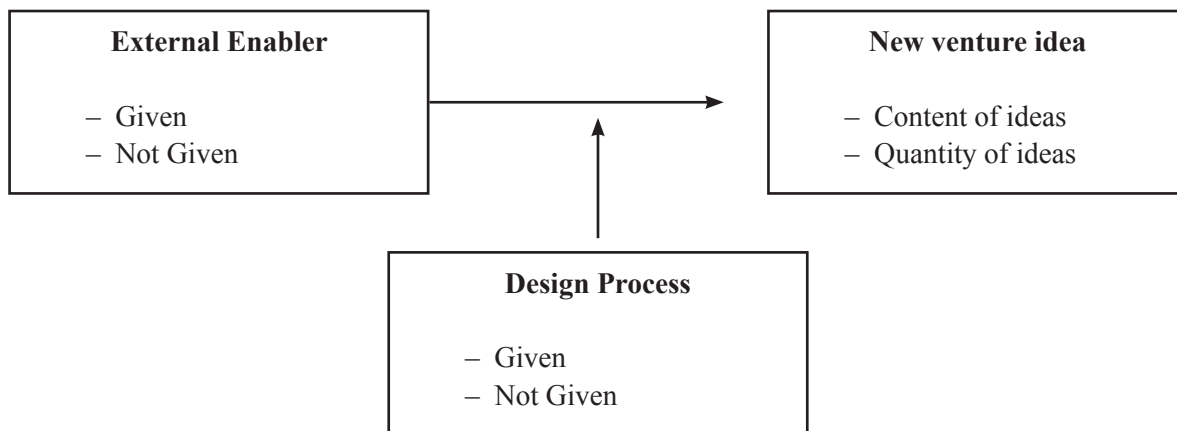


Figure 1. The conceptual framework of this study.

Thus,

H1: The presence of an external enabler has a positive effect on new venture ideas.

H1a: The participants who received an external enabler will generate a higher number of ideas than the base group.

H1b: The participants who received an external enabler will generate higher scores for the content of their ideas than the base group.

H2: The application of different types of external enabler has an effect on new venture ideas.

H2a: The application of different types of external enablers has an effect on the number of new venture ideas generated.

H2b: The application of different types of external enablers has an effect on the content of the new venture ideas generated.

Design Process and New Venture Idea Development

As previously mentioned, the new venture idea development process shares the same characteristics as the product design development process. It also requires the development of a business concept including: a product/service concept, a market concept, and the means to serve the market (Cardozo, 1986). According to Dym, Agogino, Eris, Frey, and Leifer (2005), the definition of design is a systematic and intelligent process used to generate, evaluate, and specify concepts that achieve consumers' needs within the specific constraints. The process consists of divergent-convergent thinking as well as creativity and analytical thinking. According to Plattner, Meinel, and Weinberg (2009), the design process integrates the technical feasibility, economic value, and customer needs. According to Sheppard (2003), the essence of the design process is that it consists of all stages involved in idea development, including the creation, assessment, selection, and production of ideas. Therefore, it appears that the design process can enhance an individual's ability to generate both the number and the content of ideas. Thus,

H3: The presence of the design process has a positive effect on new venture ideas.

H3a: The participants who received the design process will generate a higher number of ideas than the base group.

H3b: The participants who received the design process will generate higher scores for the content of their ideas than the base group.

External Enablers, Design Process, and New Venture Idea Development

The objective factors that enable entrepreneurial activity are increasingly recognized by many researchers (Davidsson, 2015; Nambisan, 2016; Shane, 2012). Shane and Venkataraman (2000) portrayed such factors as sources of the characteristics of entrepreneurial activity. The opportunity is accurately interpreted by the entrepreneurial agent before it is acted upon. Davidsson (2015) theorized about external enablers by identifying the enabling mechanism. The effect of external enablers on the outcome of the entrepreneurial process has been conceptualized, but not empirically tested. Most of the entrepreneurial literature considered the objective factors as given.

Venkataraman et al. (2012) suggested that entrepreneurial opportunity (business idea) is not only given or created, but it is designed. The design theory, through the application of the science of the artificial, serves as the bridge between the discovery and creation theory. Entrepreneurial literature has constructively suggested that opportunities/ideas can be both made and found, that the entrepreneurial process needs to surpass new combinations to transformations, and that the development of opportunities needs a new nexus around actions and interactions. Consequently, objective phenomena, like external enablers, can be discovered, but they are only transformed into business ideas through the mechanism of the design process.

Previous literature also supports the idea of how the application of the design theory in the science of the artificial can explain the new venture idea development. The science of the artificial has been applied to study the entrepreneurial process (Sarasvathy, 2003). The study of the science of the artificial involves studying the adaptations of means to the environment through

the process of design (Simon, 1969). The core concept of design is the conception and realization of new things (Cross, 1982). Hence, the application of the design process can help explain how an individual creates a new venture idea from the provided objective opportunity.

Therefore, it appears that both the application of external enablers and the design process can enhance an individual's ability to generate both the number and the content of ideas. Thus,

H4a: The application of an external enabler and the design process has a positive effect on the number of new venture ideas.

H4a-1: The participants who were given both an external enabler and the design process will generate a higher number of new venture ideas than the base group.

H4a-2: The participants who were given both an external enabler and the design process will generate a higher number of new venture ideas than the group that only received an external enabler.

H4a-3: The participants who were given both an external enabler and the design process will generate a higher number of new venture ideas than the group that only received the design process.

H4b: The application of an external enabler and the design process has a positive effect on the content of new venture ideas.

H4b-1: The participants who were given both an external enabler and the design process will generate higher scores for the content of their ideas than the base group.

H4b-2: The participants who were given both an external enabler and the design process will generate higher scores for the content of their ideas than the group that only received an external enabler.

H4b-3: The participants who were given both an external enabler and the

design process will generate higher scores for the content of their ideas than the group that only received the design process.

Categorization by the type of external enabler has limited theoretical potential because the structural form and function of any enabling factors remain concealed and static. Rather, focusing on the characteristics, mechanisms, and roles are more promising notions of external enablers. The scope of external enablers has important implications for the breadth of ideas that individual ventures pursue (Davidsson, Hunter, & Klofsten, 2006).

Davidsson and Tonelli (2013) highlighted that different types of enablers can have similar scope, onset, and agency-intensity, whereas enablers of the same type can differ markedly in these respects. In this present study, analysis of the possible effects of external enablers led to the delineation of a set of mechanisms by which these enablers can facilitate venture creation. Analysis of the mechanism level can arguably yield much deeper insights than a discussion on the different types of enablers. Therefore, the application of different types of external enablers and the design process as the cognitive mechanism can enhance the individual's ability to generate both the number and the content of ideas. Thus,

H5: The effect of the application of different types of external enablers and the design process on new venture idea development is higher than the effect of the application of different types of external enablers alone.

H5a: The average number of new venture ideas generated by all groups that received the applications of external enablers and the design process will be higher than all groups that received external enablers alone.

H5b: The average score of new venture ideas generated by all groups that received the applications of external enablers and the design process will be higher than all groups that received external enablers alone.

Methods

In this study, the experimental research approach was adopted for four main reasons. First, experimental research provides a situational approach which helps to separate the complex phenomena that drive opportunity recognition and idea generation. Using this approach enables researchers to control and observe subjects in a controllable environment. In this research, the application of experimental design facilitates the study of such complex activities as opportunity recognition and idea generation. Second, the nature of experimental research enables researchers to differentiate opportunity and business ideas as separate constructs. According to Gregoire et al. (2010), the experimental research design makes it possible to disconnect subjective beliefs concerning ex-ante uncertain opportunities from the objective ex-post knowledge. Third, experimental research allows researchers to study and make comparisons between the experimental group and the control group. It also allows researchers to manipulate the subjects and compare the results. Fourth, experimental research provides an empirical observation of the dynamism in the entrepreneurial process in “real time.” Since studies related to opportunity research have been criticized

for using retrospective data, which always creates a challenge in terms of external validity, the application of experimental research can help resolve such issues.

In this study, two experiments were conducted and delivered in the format of a new venture idea challenge in classrooms. With the clear principle the two experiments shared together, they were designed with different objectives, methods, and procedure.

First Experiment

The objective of the first experiment is to test the effects of external enablers and the application of the design process on new venture ideas. This study is interested in the effects of (1) external enablers, (2) the design process, and (3) external enablers and the design process together on the development of new venture ideas. Table 1 presents the 2x2 factorial design with four conditions (A1B1, A1B2, A2B1, A2B2).

Research Instruments and Measurements

To operationalize the experimental research effectively, this study used five types of instruments: idea sheets, idea scoring measurements, a pre-screening questionnaire, process instructions, and design process sheets.

Table 1
2 X 2 Factorial Design for the First Experiment

		Factor B (Design Process)	
		B1 (Applied)	B2 (Not applied)
Factor A (External enabler)	A1 (Applied)	Condition A1B1	Condition A1B2
	A2 (Not applied)	Condition A2B1	Condition A2B2

A1B1: The group receiving an external enabler and the design process

A1B2: The group receiving only an external enabler

A2B1: The group receiving only the design process

A2B2: The group receiving no treatment (base group)

The idea sheet, which consists of two parts, was developed to collect the new venture ideas from the participants. The first part is the idea description where participants can provide a short written description of their ideas. The second part is a blank space where participants can visualize their ideas through drawings. An example of the idea sheet is illustrated in Figure 2. With this format of idea collection, variations in the idea generation activity can be controlled during the experiment.

The new venture idea was operationalized by measuring the number of generated ideas and the content of the ideas. For measuring the number of ideas, the number of new venture ideas generated from the experiment was counted. For measuring the content of the ideas, the Idea Sets developed by Hill and Birkinshaw (2010) were modified. The Idea Sets comprehensively measure five aspects of the business idea: idea set content, idea set knowledge configurations, idea set volume, idea set value logic, and idea set novelty. This instrumental design uses an interval scale, which allows the data to be used with regression analysis.

The content of the ideas was coded as 0 = none of the ideas; 1 = some of the ideas; 2 = most of the ideas; and 3 = all of the ideas. In this way, the greater dimensions of the innovativeness of the ideas generated

could be measured. A higher number of content dimensions could potentially result in a greater degree of innovativeness in the new venture ideas.

Before commencing the experiment, a pilot test of the instrument was conducted to test the quality and validity of the adjusted instrument. The comments and pre-rating session for the adapted instruments were validated by three experts, comprising of an entrepreneurship scholar, an expert entrepreneur, and a researcher with experience in developing instruments in social science. The results indicated no confusion among the experts in using the study's modified instruments for rating the content of ideas.

Focusing on the effects of the design process on business ideas under a given external enabler, individual attributes were controlled to minimize the experimental artifacts. The control variables in this study included: (1) individual creativity, (2) prior knowledge, and (3) entrepreneurial intention. Data on these variables were gathered in the form of a pre-selection questionnaire. The self-rated questionnaire was adapted from previous studies (Shepherd & DeTienne, 2005; Berglund & Wennberg, 2006; Choo & Wong, 2006).

The independent variables in this study were given in the form of different treatments during the experiment. Four conditions of treatment were conducted to test the

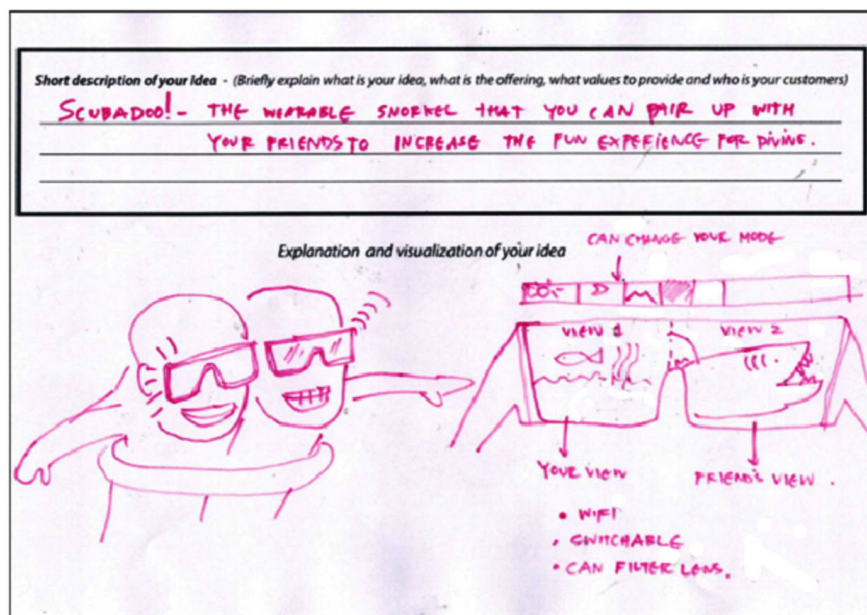


Figure 2. An example of an idea sheet.

differences in the dependent variables by delivering a different process of instructions. The treatments were given in the form of PowerPoint instructions and process manipulation during the experiments. Different groups received different instructions and process manipulation throughout their idea generation activities.

The external enabler was given in the form of a PowerPoint presentation after the introduction slide and a verbal explanation was presented. The information included a definition of wearable technology and picture examples of its application. The participants were treated by being asked to generate business ideas from this external enabler.

The design process was presented in the form of a PowerPoint presentation and process guidance during the experiment. The participants were systematically guided through each stage, including: (1) divergent, (2) transformation, and (3) convergence. The participants also received the design process sheet as a tool to use during the experiment to record their associations during the divergent and transformation stages. The participants used the sheets to correspond with the design process instructions to help them generate business ideas.

Experimental Design

The operational stage of the research began with the selection of the participants. The early stage of venture creation was the primary focus, and novice entrepreneurs without prior experience in new venture creation were used to avoid any bias arising from prior knowledge and past experience. The novice entrepreneurs who participated in this study consisted of 120 undergraduate students in international programs in Thailand. The average age was 21 years old.

All participants were screened using a self-assessment questionnaire. Then, students with average scores from the questionnaire on creativity, prior knowledge, and entrepreneurial intention were selected to participate in the experiment. After completing the pre-screening session, the participants were randomly separated into three groups. The first group received the application of an external enabler and the design process. The second group received only an external enabler without the design process. The third group

received neither an external enabler nor the design process. Next, all selected participants were given the same idea challenge before starting the idea generation activity. Wearable technology was the external enabler (objective phenomenon) and was a source of opportunity. The participants were asked to create business ideas which related to the travel and tourism industry. The experiments for each group of participants were conducted separately.

The design process was treated as one of the independent variables. Each participant in the group given the design process received the design process sheet and was asked to build a systematic structure of the new venture idea. The systematic structure consists of four topics: wearable technology, new value offering, travel and tourism industry, and customers. A total of 15 minutes was assigned to each group for the business idea generation activity. In the divergence stage, the participants were asked to generate as many associations they could think of. In the transformation stage, the participants were asked to connect the different pieces of generated associations in each category. At the convergence stage, the participants were recommended to be intuitive in choosing the associations that they thought were applicable to the business idea creation. Then, all business ideas were collected after the experiment. Three assessors who were serial entrepreneurs and had experience in both wearable technology and tourism-related businesses scored the business ideas by using the business idea scoring method. After scoring, the hypotheses were tested using the Kruskal-Wallis and Mann-Whitney tests due to the non-normal distribution of the scores.

Second Experiment

In the second experiment, the effects of different technological external enablers on new venture idea development were tested. The selected external enablers had to be novel in the current period of the experiment to reduce prior knowledge of the technologies and their relations to successful business ideas. The selection criteria are: 1) the technology must be well recognized from a valid source; 2) the technology must be relatively perceived as new technology when the experiment was performed; and 3) the selected technologies must be beneficial to the

selected industry in the experiment (in this case, the tourism industry). Following the proposed criteria, the Massachusetts Institute of Technology (MIT) Technology Review was selected for the period of 2013–2016 as the key source of technological external enablers. The three-year period of the review would allow sufficient time for individuals to recognize the potential applications of the technologies rather than these being radical new technologies with which they were not familiar. Lastly, experts were used to help in selecting the technologies which were considered relevant to the tourism industry. Six technologies were selected as a representative of the external enable construct: (1) Augmented Reality (AR), (2) Artificial Intelligence (AI), (3) 3D Printing (3D), (4) Wearable Technology (WA), (5) Drone Technology (DR), and (6) Internet of Things Technology (IOT).

To test all 12 conditions in the experimental design, three sessions of new venture idea development activities were held. The intervention of each session

was equal to one week. The structures of all experimental sessions were similar. They began with the introduction of the new venture idea generation challenge to the class. Every time the experiment was performed, a clear instruction was given by the instructor about the scope of the new venture idea generation. To control the impact of industry dynamics in the emergence of opportunity, the same new venture idea challenge from the travel and tourism industry used in the first study was repeated. The 12 conditions were randomly assigned to the three experimental sessions. To control the ordering effects in the experimental design, the four conditions were randomly ordered differently among the three sessions. After the introduction of the idea challenge, the participants were guided through all four conditions in each session. Different conditions were given in the form of different PowerPoint presentations presented by the instructor. The participants generated their business ideas individually by jotting down their ideas on the given idea sheet.

Table 2
Twelve Conditions of the Second Experiment

		External Enablers					
		AR	AI	3D	WA	DR	IOT
Design Process	Applied	C1	C3	C5	C7	C9	C11
	Not applied	C2	C4	C6	C8	C10	C12

Table 3
Experiment Procedure of the Second Experiment

Experimental Procedure	Session 1	Session 2	Session 3
1. Introduction (5 Minutes)	Introduction to the business idea challenge		
2. Condition 1 (15 Minutes)	C1	C5	C9
3. Condition 2 (15 Minutes)	C2	C6	C10
4. Condition 3 (15 Minutes)	C3	C7	C11
5. Condition 4 (15 Minutes)	C4	C8	C12

To assess the content of the new venture ideas, the Delphi method was used to give a systematic approach for achieving a consensus of the assessment. The three assessors, who were a serial entrepreneur, an entrepreneurship professor, and an experienced entrepreneur in the travel and tourism industry, were asked to score the business ideas by using the business idea scoring method. The scoring process consists of three steps: (1) all assessors give their scores for each new venture idea separately; (2) all scoring results are shared among all assessors; (3) each assessor will share his or her opinion on the assessment and discuss the opinion among the team until a consensus of the scoring results is achieved. In total, 182 business ideas were collected from the second experiment.

Results

To determine the differences between the presence of an external enabler alone, the presence of the design process alone, the presences of a combination of an external enabler and the design process, and the condition with no treatment, one-way analysis of variance (ANOVA) was used in the first experiment. To test the validity of data before running one-way ANOVA, normality tests were performed on two sets of data: number of ideas and scores for content of ideas. Normality testing showed that the number of ideas was normally distributed, with a skewness of .364 and kurtosis of -.325. Nevertheless, the scores for the content of ideas were non-normally distributed, with a skewness of .742, and kurtosis of -.663. As a result, one-way ANOVA could be performed on the

number of ideas, but it could not be performed on the scores for the content of ideas. Non-parametric tests, including Kruskal-Wallis and Mann-Whitney U tests, were used on the scores for the content of ideas instead of one-way ANOVA.

Number of New Venture Ideas

Regarding the effect of external enablers on the number of ideas, one-way ANOVA showed that there was a significant difference between the four groups: external enabler and design process condition, external enabler condition, design process condition, and no treatment condition ($F(3, 116) = 13.652, p = .000$). The findings of the first experiment revealed that the participants who received the external enabler did not generate a higher number of ideas than the base group. Thus, H1a is not supported.

From the second experiment, there was a statistically significant difference between the groups of participants that received six different types of external enabler as shown by one-way ANOVA ($F(5, 66) = 5.849, p = .000$). The results show a difference in the number of ideas produced when using different types of external enabler. Thus, H2a is supported.

When comparing the group with the design process alone to the group with no treatment, the average number of ideas generated by the treated group (Mean = 2.533, SD = 0.899) was higher than the average number of ideas for the non-treated group (Mean = 2.300, SD = 0.702). Thus, H3a is supported.

When comparing the group with both an external enabler and the design process to the group with no treatment, the average number of ideas for the treated

Table 4

Average Quantity of New Venture Ideas Produced by Groups of Participants

Group of participants	Mean	SD	SE
Group receiving external enabler and design process (A1B1)	2.667	0.959	0.175
Group receiving only external enabler (A1B2)	1.467	0.571	0.104
Group receiving only design process (A2B1)	2.533	0.899	0.164
Group receiving no treatment (A2B2)	2.300	0.702	0.128

group (Mean = 2.667, SD = 0.959) was higher than the average number of ideas for the non-treated group (Mean = 2.300, SD = 0.702). The average number of ideas for the treated group with the external enabler and the design process were also higher than the average number of ideas for the treated group with only external enabler (Mean = 1.467, SD = 0.571), and higher than the treated group with only the design process (Mean = 2.533, SD = 0.899). Thus, H4a-1, H4a-2, and H4a-3 are supported.

From the first experiment, the results showed that the total number of generated new venture ideas was higher when the design process was applied. The average number of ideas of the group given the external enabler and the design process was higher than it was for the group without treatments, the group given only the external enabler, and the group given only the design process. This finding supports the previous entrepreneurship literature in that systematic processes play key roles in the opportunity search and business idea creation stages (Heinonen, Hytti, & Stenholm, 2011). According to Heinonen et al. (2011), opportunity search strategies that are creative and based on knowledge acquisition have a positive effect on the perceived viability of the business idea.

Regarding a comparison of the mean and median number of ideas generated, the groups with different types of external enablers and the design process (Mean = 7.83, Median = 8.00, SD = 1.40) generated higher scores than the groups with different types of external enablers alone (Mean = 7.33, Median = 7.00, SD = 0.88). However, the results from a single sample t-test showed that there is no statistically significant difference between the two groups ($t(22) = 1.043$,

$p = 0.308$). Thus, H5a is not supported.

Content of New Venture Ideas

Regarding the effect of external enablers on the scores for the content of ideas, the Kruskal-Wallis test revealed that the scores for the content of ideas were significantly affected by the application of an external enabler and the design process ($H(3) = 30.131, p < .01$). The follow-up Mann-Whitney U test also showed that the scores for the content of ideas were significantly higher when an external enabler was provided ($U = 1016.000, r = -3.137$). Thus, H1b is supported.

From the second experiment, regarding the effect of different external enablers on the scores for the content of ideas, the Kruskal-Wallis H test revealed that there was a statistically significant difference between the groups of participants that received six different types of external enablers, with $p = 0.000$. Thus, H2b is supported.

Regarding the effect of the design process on the scores for the content of ideas, as was stated earlier, the Kruskal-Wallis test revealed that the application of an external enabler and the design process had a significant effect on the scores for the content of ideas ($H(3) = 30.131, p < .01$). Nevertheless, the follow-up Man-Whitney test showed that the scores for the content of the ideas were not significantly higher when the design process was also provided ($U = 2244.000, r = -1.550$). The participants who received the design process were not able to generate higher scores for the content of their ideas than the participants who did not receive the design process. Thus, H3b is not supported.

Table 5
Total Number of New Venture Ideas Produced in the Second Experiment

	Total number of ideas	Mean	Median	SD
Groups with different types of external enablers and the design process (C1, C3, C5, C7, C9, C11)	94	7.83	8.00	1.40
Groups with different types of external enablers alone (C2, C4, C6, C8, C10, C12)	88	7.33	7.00	0.88

Regarding the effect of external enablers and the design process on the scores for the content of ideas, the results of the Mann-Whitney test showed that the participants who received both an external enabler and the design process could generate higher scores for the content of the ideas than the participants who received no treatment ($U = 2087.000$, $r = -2.551$). The scores were also higher than those for the participants who received only the design process ($U = 1971.000$, $r = -4.071$). However, the participants who received both an external enabler and the design process were not able to generate higher scores for the content of the ideas than the participants who received only an external enabler ($U = 1675.000$, $r = -.655$). Thus, H4b-1 and H4b-3 are supported, but H4b-2 is not supported.

From the first experiment, the finding showed that the score for the content of ideas of the group given an external enabler and the design process was higher than for the group that received no treatment. This finding can help to provide a better understanding of the concepts of the Idea Sets introduced by Hill and Birkinshaw (2010). However, the score for the content of ideas of the group given an external enabler and the design process was not higher than for the group given only an external enabler. This might be in some part due to the results from the judgment of the assessors on the outcomes or different experiences of the participants with the specific technology and the targeted industry. Hence, the different types of external enablers and the setting of the market environment were applied to validate the effects of external enablers on the content of ideas.

From the second experiment, a Kruskal-Wallis H test showed that there was a statistically significant difference between the group of participants that received different types of external enablers and the design process and the group of participants that received different types of external enablers alone; the reported results were $p = .027$. This result revealed that the participants who received different types of external enablers and the design process had a higher median score for new venture ideas (Median = 3.00) than the participants who received different types of external enablers alone (Median = 2.00). It indicated that the average scores for ideas generated by all groups that

received the applications of different types of external enablers and the design process were higher than for all groups that received different types of external enablers alone. Thus, H5b is supported.

Discussion

For the effects of external enablers, the results from both experiments revealed that the application of an external enabler had a positive effect on both the number and the quality of the ideas generated by the participants in this study. This finding also supports the previous studies on the opportunity discovery theory, such as the birth of new technology, in terms of affecting the generation of new venture ideas (Shane, 2012). As the theory explains, the objective phenomena that create new means-end frameworks play key roles as stimuli for individuals to create subjective conjectures. The findings of this current study correspond to previous studies in concluding that objective phenomena affect business ideas, which are referred to as entrepreneurial opportunities in the discovery theory (e.g., Shepherd & De Tienne, 2005; Ucbasaran, Westhead, & Wright, 2008; Corbett 2002; Gaglio & Taub, 1992; Ropo & Hunt, 1995). The findings of the second experiment confirmed the validity of the external enabler construct as the representative of objective opportunity or exogenous shock. As several external enablers were applied in this research, and they all reported positive impacts on new venture idea development, it can be concluded that external enablers serve as active stimuli that positively affect both the number and the content of the ideas generated, regardless of which types of external enablers are applied.

For the effects of the design process, the results showed that its application has a positive effect on the quantity of ideas but does not affect the content of the ideas. The results from this research showed that the total number of generated ideas is higher when the design process is applied. This finding supports the previous entrepreneurship literature in that systematic processes play key roles in the opportunity search and new venture idea creation stages (Heinonen et al., 2011). However, no evidence was found in this study to support the hypothesis that the application of the

design process affects the content of the ideas being generated.

For the effects of the combined application of an external enabler and a design process on new venture ideas, the results from both experiments showed that the combined application of the two variables affects new venture idea creation results. Even though it cannot be concluded that the application of an external enabler and the design process together leads to a better performance in terms of new venture idea development when compared to the performance of the group that received only external enablers, it is, nevertheless, interesting to observe that the group which received an external enabler and the design process generated higher scores for the content of their ideas compared to the scores for the group that received only the design process. This also supports the theoretical concept of this study that entrepreneurial opportunity in the IO nexus can be viewed as an artifact and can be used to develop new venture ideas through the application of the science of the artificial.

Overall, this research showed that by using disruptive technological change as an external enabler and the design process as a cognitive mechanism, the quantity and quality of new venture ideas generated can provide deeper understanding of the entrepreneurial process in the IO nexus and clarification of testable constructs in the opportunity discovery theory. The theoretical explanation of the entrepreneurial process was extended in this study with the application of the science of the artificial to examine the transformation of opportunities into new venture ideas. A research design that enables researchers to test the effects of objective phenomena and subjective conjecture with the research instruments for measuring new venture ideas was developed. For practical implication, the designed experiment can be used in classroom activities and applied to the idea generation process of novice entrepreneurs. For future research, new studies can be conducted using participants with different levels of experience to examine the effect on new venture idea development. Different types of design process, such as visual thinking or other creative-based design processes, can also be tested in future studies.

This current study has provided fundamental data and findings for future researchers who want to join the

quest for the role of external enablers and the design process in new venture idea development as part of the concept of theoretical development. Due to several limitations in different aspects of the research in this current study, new possible future research which can be built from this study is proposed.

First, this study used only novice entrepreneurs to participate in the business idea development experiment. Since the previous literature has shown that different types of entrepreneurs exhibit different behaviors (Ucbasaran et al., 2008), the future study in this field could include another research to validate the effects of individuals with different levels of entrepreneurial experience on new venture idea development. Second, this study selected the tourism industry as the targeted industry for its business idea development activities. According to Shane (2001), different industries share different dynamics that could lead to different business idea development outcomes. Future research could apply the research design of this study to conduct a business idea development activity in different targeted industries (e.g., technology, property development, etc.). Third, the application of the design process in this experiment builds on the work of Jones (1970) who classified the design process into three stages: (1) divergent, (2) transformation, and (3) convergent. To explore the connection between the entrepreneurship discipline and the design discipline, future research could explore other design-related processes to validate their effects on business idea development. For example, future research could apply other creative-based design processes and techniques, such as visual thinking (Wang, Cosley, & Fussell, 2011) or the systematic creativity method (Ogot & Okudan, 2006) to business idea development. Fourth, the experiments in this study faced some limitations regarding the number of participants and total business ideas generated due to limited available resources and time constraints. Thus, a non-parametric statistical test was performed in this research. To improve the research validity, future research should consider increasing the number of participants, which should result in an increasing number of business ideas generated.

Lastly, the external enablers applied in this study were limited to only technological external enablers.

It would be interesting for future research to apply other concepts of source changes (Eckhardt & Shane, 2003) as alternative external enablers, and to explore their effects on new venture idea development.

Ethical clearance:

The study was approved by the institution.

Conflict of interest:

None.

References

- Alvarez, S.A., & Barney, J. B. (2007). Discovery and creation: Alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal*, 1(1-2), 11–26. doi: 10.1002/sej.4/epdf
- Alvarez, S. A., Barney, J. B., & Anderson, P. (2012). Forming and exploiting opportunities: The implications of discovery and creation process for entrepreneurial and organizational research. *Organization Science*, 24(1), 301–317. doi: 10.1287/orsc.1110.0727
- Alvarez, S. A., & Barney, J. B. (2013). Epistemology, opportunities, and entrepreneurship: Comments on Venkataraman et al. (2012) and Shane (2012). *Academy of Management Review*, 38(1), 154–157. Retrieved from <https://tinyurl.com/ybmvxn2u>
- Ardichvili, A., Cardozo, R., & Ray, S. (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing*, 18(1), 105–123. Retrieved from <https://tinyurl.com/yas9wdm5>
- Arenius, P., & De Clercq, D. (2005). A network-based approach on opportunity recognition. *Small Business Economics*, 24(3), 249–265. Retrieved from <https://tinyurl.com/y9d9dfsw>
- Baron, R. A. (2006). Opportunity recognition as pattern recognition: How entrepreneurs “connect the dots” to identify new business opportunities. *The Academy of Management Perspectives*, 20(1), 104–119. Retrieved from <https://tinyurl.com/yba3r9qy>
- Berglund, H., & Wennberg, K. (2006). Creativity among entrepreneurship students: Comparing engineering and business education. *International Journal of Continuing Engineering Education and Life Long Learning*, 16(5), 366–379. Retrieved from <https://tinyurl.com/ybpugdqu>
- Bird, B. (1988). Implementing entrepreneurial ideas: The case for intention. *Academy of management Review*, 13(3), 442–453.
- Cardozo, R. N. (1986). *Product classification in marketing: An appraisal and proposal* [White paper]. Carlson School of Management, University of Minnesota, Minneapolis.
- Choo, S., & Wong, M. (2006). Entrepreneurial intention: Triggers and barriers to new venture creations in Singapore. *Singapore Management Review*, 28(2), 47–64. Retrieved from <https://tinyurl.com/ybtq43fv>
- Corbett, A. C. (2002). Recognizing high-tech opportunities: A learning and cognitive approach. *Frontiers of Entrepreneurship Research*, 1(2), 49–61. Retrieved from <https://tinyurl.com/y9nj7um9>
- Corbett, A. C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of Business Venturing*, 22(1), 97–118. doi: 10.1016/j.jbusvent.2005.10.001
- Cross, N. (1982). Designerly ways of knowing. *Design studies*, 3(4), 221–227.
- Davidsson, P., Hunter, E., & Klofsten, M. (2006). Institutional forces: The invisible hand that shapes venture ideas? *International Small Business Journal*, 24(2), 115–131.
- Davidsson, P., & Tonelli, M. (2013). Towards an operable entrepreneurship nexus: Conceptualizing venture ideas and their characteristics. In L. Toombs (Ed.), *73rd annual meeting of the Academy of Management: Capitalism in question, August 9–13, Orlando, Florida*. Retrieved from <https://tinyurl.com/yafkdbt>
- Davidsson, P. (2015). Entrepreneurial opportunities and the entrepreneurship nexus: A re-conceptualization. *Journal of Business Venturing*, 30(5), 674–695. doi: 10.1016/j.jbusvent.2015.01.002 2
- Dimov, D. (2011). Grappling with the unbearable elusiveness of entrepreneurial opportunities. *Entrepreneurship Theory and Practice*, 35(1), 57–81. doi: 10.1111/j.1540-6520.2010.00423.x
- Dym, C. L., Agogino, A. M., Eris, O., Frey, D. D., & Leifer, L. J. (2005). Engineering design thinking, teaching, and learning. *Journal of Engineering Education*, 94(1), 103–120. Retrieved from <https://tinyurl.com/yamfhjt7>
- Eckhardt, J., & Shane, S. (2013). Response to the commentaries: The individual opportunity (IO) nexus integrates objective and subjective aspects of entrepreneurship. *Academy of Management Review*, 38(1), 160–163. doi: 10.5465/amr.2012.0192
- Gaglio, C. M., & Taub, R. P. (1992). Entrepreneurs and opportunity recognition. *Frontiers of entrepreneurship research*, 12, 136–147.
- Gregoire, D. A., Shepherd, D. A., & Lambert, L. S. (2010). Measuring opportunity-recognition beliefs illustrating and validating an experimental approach. *Organizational Research Methods*, 13(1), 114–145. doi: 10.1177/1094428109334369

- Heinonen, J., Hytti, U., & Stenholm, P. (2011). The role of creativity in opportunity search and business idea creation. *Education+Training*, 53(8/9), 659–672. doi: 10.1108/00400911111185008
- Hill, S. A., & Birkinshaw, J. M. (2010). Idea sets: Conceptualizing and measuring a new unit of analysis in entrepreneurship research. *Organizational Research Methods*, 13(1), 85–113. doi: 10.1177/1094428109337542
- Hsiao, S.W., & Chou, J.R. (2004). A creativity-based design process for innovative product design. *International Journal of Industrial Ergonomics*, 34(5), 421–443. doi: 10.1016/j.ergon.2004.05.005
- Jones, J C Design Methods Wiley, Chichester, UK (1970)
- Korsgaard, S. (2013). It's really out there: A review of the critique of the discovery view of opportunities. *International Journal of Entrepreneurial Behavior & Research*, 19(2), 130–148. doi: 10.1108/13552551311310347
- Krippendorff, K., & Butter, R. (2008). Semantics: Meanings and contexts of artifacts. In *Product experience* (pp. 353–376). Lumpkin, G. T., & Lichtenstein, B. B. (2005). The role of organizational learning in the opportunity-recognition process. *Entrepreneurship Theory and Practice*, 29(4), 451–472. Retrieved from <https://tinyurl.com/y8mgk3sm>
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029–1055.
- Ogot, M., & Okudan, G. E. (2006). Integrating systematic creativity into first-year engineering design curriculum. *International Journal of Engineering Education*, 22(1), 109.
- Osterwalder, A. (2004). *The business model ontology: A proposition in a design science approach* (Unpublished doctoral dissertation). Institut d'Informatique et Organisation. Lausanne, Switzerland, University of Lausanne, Ecole des Hautes Etudes Commerciales HEC, 173. Retrieved from <https://tinyurl.com/y88v3wv6>
- Plattner, H., Meinel, C., & Weinberg, U. (2009). *Design thinking*. Landsberg am Lech: Mi-Fachverlag.
- Ropo, A., & Hunt, J. G. (1995). Entrepreneurial processes as virtuous and vicious spirals in a changing opportunity structure: A paradoxical perspective. *Entrepreneurship Theory and Practice*, 19(3), 91–111.
- Schumpeter, J. A. (1961). *The theory of economic developments: an inquiry into profits, capital, credit, interest, and the business cycle*. Harvard University Press.
- Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), 217–226. Retrieved from <https://tinyurl.com/y9r9x2og>
- Shane, S. (2001). Technology regimes and new firm formation. *Management Science*, 47(9), 1173–1190. Retrieved from <https://tinyurl.com/yb53shxn>
- Shane, S. A. (2003). *A general theory of entrepreneurship: The individual-opportunity nexus*. Northampton, MA: Edward Elgar Publishing.
- Shane, S. (2012). Reflections on the 2010 AMR decade award: Delivering on the promise of entrepreneurship as a field of research. *Academy of Management Review*, 37(1), 10–20. doi: 10.5465/amr.2011.0078
- Shepherd, D. A., & DeTienne, D. R. (2005). Prior knowledge, potential financial reward, and opportunity identification. *Entrepreneurship Theory and Practice*, 29(1), 91–112. doi: 10.1111/j.1540-6520.2005.00071.x
- Sheppard, S. D. (2003). A description of engineering: An essential backdrop for interpreting engineering education. In *Proceedings (CD), Mudd Design Workshop IV*. Harvey Mudd College.
- Simon, H. A. (1969). *The sciences of the artificial*. Cambridge, MA: MIT Press.
- Sarasvathy, S. D. (2003). Entrepreneurship as a science of the artificial. *Journal of Economic Psychology*, 24(2), 203–220. doi: 10.1016/S0167-4870(02)00203-9
- Sarasvathy, S. D., Dew, N., Velamuri, S. R., & Venkataraman, S. (2003). Three views of entrepreneurial opportunity. In Z. J. Acs & D. B. Audretsch (Eds.), *Handbook of entrepreneurship research* (pp. 141–160). Norwell, MA: Kluwer Academic Publishers. Retrieved from <https://tinyurl.com/yd3gve73>
- Singh, R. P., Hills, G. E., Lumpkin, G. T., & Hybels, R. C. (1999, August). The entrepreneurial opportunity recognition process: Examining the role of self-perceived alertness and social networks. In *Academy of Management Proceedings* (Vol. 1999, No. 1, pp. G1–G6). Briarcliff Manor, NY 10510: Academy of Management.
- Venkataraman, S., Sarasvathy, S. D., Dew, N., & Forster, W. R. (2012). Reflections on the 2010 AMR decade award: Whither the promise? Moving forward with entrepreneurship as a science of the artificial. *Academy of Management Review*, 37(1), 21–33. doi: 10.5465/amr.2011.0079
- Ucbasaran, D., Westhead, P., & Wright, M. (2008). Opportunity identification and pursuit: Does an entrepreneur's human capital matter? *Small Business Economics*, 30(2), 153–173. doi: 10.1007/s11187-006-9020-3
- Wang, H. C., Fussell, S. R., & Cosley, D. (2011, March). From diversity to creativity: Stimulating group brainstorming with cultural differences and conversationally-retrieved pictures. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work* (pp. 265–274). ACM.