



Entrepreneurial Passion and Opportunity Recognition: Insights from Business and Engineering Students

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Abstract: This study examines the dynamic interactions between entrepreneurial passions and opportunities between 402 people and engineering students and examines how gender-specific pedagogical backgrounds influence this relationship. Equipped with social cognitive theory, we used a 20-point survey to explore and apply students to uncover four key entrepreneurial characteristics: innovation drive, owner passion, leadership and growth, opportunity, and sustainability. Our results show that entrepreneurial passions significantly improve opportunities and that business students outperform their technical counterparts with market-oriented training. Gender differences have arisen as male students show a more passionate tendency to identify opportunities than students. While the perception of opportunity correlated with vigilance rather than exploitation, passion began the entrepreneurial intentions communicated by self-efficacy among creative students. These findings highlight the mutual role of passion and cognitive skills in promoting entrepreneurial behavior. We recommend interdisciplinary education, targeted support for female students, and practical projects that close the gap between potential detection and setup. By promoting passion and confidence in various student groups, educators, and political decisions, we can build a new generation of innovative entrepreneurs willing to promote economic and social progress.

Keywords: entrepreneurial passion, opportunity recognition, business students, engineering students, Social Cognitive Theory

INTRODUCTION

By establishing businesses that tackle problems or satisfy market demands, entrepreneurship promotes innovation, economic growth, and societal advancement (Shane & Venkataraman, 2000). Two essential components of entrepreneurial success are opportunity recognition, or the capacity to identify and assess business ideas (Ardichvili et al., 2003), and entrepreneurial passion, or a strong emotional commitment that inspires people to overcome barriers and pursue their objectives (Cardon et al., 2013). These components interact dynamically, with opportunity recognition enhancing passion and passion fostering the search for opportunities, creating a crucial ecosystem for entrepreneurship (Baron, 2006).

This study looks at how business and engineering students, whose different backgrounds influence their entrepreneurial tendencies, interact in terms of entrepreneurial zeal and opportunity perception. While engineering students, who are more concerned with technical innovation, provide solutions, business students, who are adept at market analysis and strategy, are excellent at evaluating prospects (Kuckertz et al., 2017). We fill a knowledge vacuum by investigating how environmental factors like education and personal characteristics like passion impact entrepreneurial behavior using Social Cognitive Theory (Bandura, 1986) (Nabi et al., 2015).

Entrepreneurial intention (EI), a key predictor of entrepreneurial activity, is shaped by factors like education, self-efficacy, creativity, and passion (Krueger et al., 2000; Bacq et al., 2017). As governments cannot guarantee jobs for all graduates, students

must shift from job-seeking to job-creating mindsets (Reuel Johnmark et al., 2016). This study investigates how these antecedents—especially passion—drive EI, offering insights into preparing students for an entrepreneurial future.

Building fundamental knowledge and skills and inspiring students to pursue entrepreneurship are two important functions of entrepreneurial education (Walter & Block, 2016). It improves the quality and success of entrepreneurship by encouraging both cognitive skills (such as recognizing opportunities) and emotional engagement (such as passion) (Galloway & Brown, 2002). Our study demonstrates how specialized instruction can bridge the gaps between business and engineering students' distinct talents and unleash their potential.

The results have useful ramifications for encouraging entrepreneurship. Policymakers may encourage cross-disciplinary cooperation, educators can create interdisciplinary curricula that include technical and business abilities, and industry can guide aspiring business owners (Barba-Sánchez et al., 2022). This study emphasizes how students' passion and ability to see opportunities can connect technical skills with market strategies, as entrepreneurial ambition becomes increasingly important for job creation and economic competitiveness (Krueger et al., 2000).

OBJECTIVE OF THE STUDY

To study the effect of entrepreneurial passion on opportunity recognition among business and engineering students.

To study the effect of gender on the relationship between entrepreneurial passion and opportunity recognition among business and engineering students.

To study the effect of education on the relationship between entrepreneurial passion and opportunity recognition among business and engineering students.

HYPOTHESIS

H1: Entrepreneurial passion has a positive and significant difference in opportunity recognition.

H2a: Male students are more driven by passion towards opportunity recognition.

H2b: Female students are less likely to be driven by passion towards opportunity recognition.

H3: Business students are more likely to exhibit higher levels of entrepreneurial passion and opportunity recognition than engineering students.

H4: Opportunity recognition will demonstrate a stronger positive correlation with the entrepreneurial alertness dimensions than opportunity exploitation.

REVIEW OF LITERATURE

In their 2009 research, Cardon, Wincent, Singh, and Drnovsek delve into the concept of entrepreneurial passion and its influence on the entrepreneurial process. They explore the literature on passion, which is described as a consciously accessible, intense positive feeling arising from engagement in activities that align with an entrepreneur's self-identity. The authors propose that entrepreneurial passion manifests as a complex pattern of psychological, brain, and body responses that, when regulated, can motivate entrepreneurs to pursue their goals effectively. The research delves into the relationship between entrepreneurial passion and goal-related cognitions, as well as the impact on entrepreneurial behaviors such as creative problem-solving, persistence, and absorption. The authors also examine the contingent nature of entrepreneurial passion, considering factors such as the specific role identity invoked and the type of entrepreneurial outcome pursued.

Zhu et al. (2024) investigate the interplay between entrepreneurial passion, alertness, and opportunity recognition in dynamic environments. Their research focuses on the mechanisms through which passion influences opportunity recognition and the specific conditions under which this relationship occurs. The study examines the role of entrepreneurial alertness, a cognitive framework that facilitates the perception and evaluation of opportunities, as a mediator between passion and opportunity recognition. Additionally, the research explores the moderating effect of environmental dynamism, suggesting that the relationship between passion and alertness is more pronounced in dynamic environments where entrepreneurs need to adapt to constant shifts in market conditions and technology.

Anjum, Heidler, Amoozegar, and Anees (2021) explore the influence of entrepreneurial passion on entrepreneurial intention, with a focus on the moderating role of perception of university support. Their research examines how entrepreneurial passion, characterized by intense positive emotions and a strong identification with specific entrepreneurial activities, can shape an individual's intention to pursue an entrepreneurial career. The study also investigates how the perception of university support can moderate this relationship, suggesting that a supportive university environment can enhance the positive impact of passion on entrepreneurial intention.

Wasdani and Manimala (2015) examine the opportunity recognition skills (ORS) of entrepreneurs and their association with different paths to entrepreneurship and types of innovations. Their research focuses on the key components of ORS, including alertness, problem-solving, learning, and implementation orientations. The study investigates the linkages between ORS and various factors such as the nature of entrepreneurial innovation (radical or incremental), paths to entrepreneurship (innovation, growth, inheritance, or necessity), and functional types of innovation (operations, marketing, organizational, or boundary management). The research provides insights into the complex interplay between opportunity recognition, innovation, and entrepreneurial paths.

Tu, Hao, Rosak-Szyrocka, Vasa, and Zhao (2023) explore the impact of obsessive passion on entrepreneurial performance, with a focus on the mediating role of opportunity recognition and the moderating effects of fear of failure. Their research examines how obsessive passion, characterized by a strong inclination toward an activity, can drive individuals to engage in entrepreneurial activities and achieve entrepreneurial goals. The study also investigates the mediating role of opportunity recognition, suggesting that obsessive passion can enhance opportunity recognition, which in turn leads to improved entrepreneurial performance. Additionally, the research explores the dual moderating effects of fear of failure, suggesting that both endogenous and exogenous fear of failure can influence the relationship between obsessive passion and opportunity recognition.

Costa, Zalewska-Kurek, Frederiks, and Hatak (2023) delve into students' ability to recognize entrepreneurial opportunities, emphasizing the roles of need for autonomy and passion for inventing. Their research draws on self-determination theory to propose that students' need for autonomy is positively associated with their opportunity recognition ability. Additionally, the study integrates broaden-and-build theory to suggest that entrepreneurial passion, characterized by intense positive emotions and a strong identification with entrepreneurial activities, can enhance students' opportunity recognition abilities. The research provides insights into the motivational and affective factors that contribute to successful opportunity recognition among students.

Lee (2020) delves into the relationship between entrepreneurial passion and firm performance through four comprehensive essays. The research explores the impact of different types of entrepreneurial passion, including obsessive, harmonious, developing, and inventing passions, on firm performance. It also examines the mechanisms and boundary conditions that influence these relationships, such as identity fusion, bricolage, organizational innovation, overwork, and entrepreneurial autonomy. The study provides a nuanced understanding of how different types of passion can contribute to or hinder firm performance, depending on the specific context and the entrepreneur's behaviors.

Al-Awbathani and Malek (2019) examine the impact of entrepreneurial passion and entrepreneurial outcome expectations on students' entrepreneurial career choices in Saudi Arabia, using the Social Cognitive Career Theory (SCCT) framework. Their research investigates the mediating role of entrepreneurial outcome expectations, suggesting that entrepreneurial passion can influence career choices by shaping individuals' expectations about the outcomes of entrepreneurial activities. The study provides insights into the motivational and cognitive factors that guide students' career decisions in the context of entrepreneurship.

Wasdani and Mathew (2014) explore the concept of potential for opportunity recognition (ORP) and the factors that differentiate entrepreneurs with high ORP from those with low ORP. Their research investigates the influence of various factors on ORP, including social capital, self-efficacy, cognitive style, and motivation. The study examines how these factors contribute to entrepreneurs' ability to recognize and capitalize on opportunities, highlighting the importance of understanding the individual and interpersonal factors that drive successful opportunity recognition.

Thorgren, S., & Wincent, J. (2015) This research paper investigates the differences in entrepreneurial interest between traditional entrepreneurs (entrepreneurs and entrepreneurs) and new entrepreneurs. The dual desire model was tested on a sample of entrepreneurs who registered a limited company in 2008 using the dual desire model as a principle. However, among the two passions proposed in the passion model (harmonious passion and obsessive passion), the anti-obsessive response is especially true among business people. A closer examination comparing novice, serial and portfolio entrepreneurs shows that portfolio entrepreneurs score highest on consistency of passion.

Cardon, M. S., & Kirk, C. P. (2015). This research focuses on the issue of absorption in order to determine why some entrepreneurs retire while others persist, by analyzing the interplay between passion and self-efficacy. Data from 129 entrepreneurs show that the relation between self-efficacy and persistence is mediated by a passion for invention and founding, but not for firm development. These results indicate that entrepreneurial passion is an important factor of persistence and provide a rationale for the effectiveness of self-efficacy in making active entrepreneurial efforts more sustained.

Nasiru, A., Ooi, Y. K., & Bhatti, M. A. (2015). The research explains elements that affect students' inclination towards entrepreneurship. These factors are university support, disposition towards creativity and passion to create and start businesses. It is rather surprising, the perceived effectiveness of entrepreneurship education is adverse to intentions suggesting it is a box to be ticked rather than an opportunity to be utilized. The study highlights the lack of focus on practical, relevant, and engaging aspects of entrepreneurship education as a constraint to better motivate the students.

Bodnar, C. A., Clark, R. M., & Besterfield-Sacre, M. (2015). The boot camp enhanced students' entrepreneurial skills, emphasizing creativity, customer focus, and business acumen. Post-camp surveys showed increased confidence and commitment to innovation, with feedback and follow-ups confirming its positive impact on entrepreneurial development.

Renko, M., El Tarabishy, A., Carsrud, A. L., & Brännback, M. (2015) Although entrepreneurial culture is popular in popular media and classrooms, it is not yet established in academic discipline. We develop a business leadership culture and argue that it influences and directs the work of team members to achieve organizational goals, including recognition and use in the business world. We discuss environmental, organizational, and stakeholder factors that may influence successful business leadership and test the reliability and validity of the measurement tools for this construct (scale). Using this new measurement tool, we find that entrepreneurial leadership is more prevalent among creative leaders than among noncreative leaders, suggesting a valid construct.

Kazeem, A. A., & Asimiran, S. (2016) This study investigates the factors affecting entrepreneurial self-efficacy (ESE) among engineering students in Malaysian public universities by focusing on personality, family background and business education. A study conducted with 204 students revealed the difference between positive attitude and ESE and highlighted their importance in

developing work confidence. There is also a positive relationship between ESE and family support and business education. Multiple regression analysis showed that three variables, business education, family support and positive attitude, can reliably predict ESE. The findings highlight the importance of these factors in promoting entrepreneurship among engineering students.

Thiranyagama, R. K. (2016) This paper examines the potential for transferring accounting and engineering professionals to entrepreneurs in small and medium enterprises (SMEs) in Sri Lanka. Using a qualitative research method, 12 semi-structured interviews and 3 focus groups were conducted with entrepreneurs who were successfully running businesses in the SME sector. The findings clearly show that personal success factors such as risk taking, need for achievement, internal control, confidence, satisfaction, need for recognition, working for need and finding opportunities that will help engineers and accountants do their jobs are important factors. It is also influenced by environmental factors such as family background, government policy approval, social interaction and business culture. It also shows that entrepreneurs prefer to start businesses in the technology sector, while business people are involved in different disciplines. The article concludes with a discussion of the implications of the findings for engineers, accountants and national policy makers.

Mandel, R., & Noyes, E. (2016) The purpose of this article is to analyze entrepreneurship education (programs and courses) at the “top 25” graduate business schools in the United States. The motivation is to understand the diversity and importance of awareness initiatives across the country. A related goal is to identify barriers to bringing knowledge to market and to identify affordable, workable options. The authors surveyed directors, presidents, and directors of graduate programs for the inventory and reviewed the experiences of senior business operations. The target audience for the study is market researchers and business executives.

Biraglia, A., & Kadile, V. (2017) The analysis explains how entrepreneurial passion and creativity serve as precursors to entrepreneurs’ intentions through social cognitive theory. In particular, this study deals with American homebrewing in the perspective of seeing it as a possible entrepreneurs’ breeding ground. The results show that even self-efficacy as a mediator can’t erase the strong positive correlation between entrepreneurial passion and intentions. On the other hand, a measure of entrepreneurial self-efficacy helps to explain the creativity intentions, suggesting that persons must also have sufficient self-efficacy beliefs in order to actively seek out an entrepreneurial career. The results enhance the perspectives of the new venture creation phenomenon in the context of the specific hobby.

Fellnhöfer, K. (2017) This study investigates the impact of the business model on job satisfaction and intention using data from 426 individuals in Austria, Finland, and Greece. Structural equation modeling (SEM) revealed direct and indirect effects of the model mediated by satisfaction, with the strongest effect being indicated by many descriptive statements. The findings, based on planning behavior and social learning theory, demonstrate the effectiveness of web-based multimedia as a teaching tool for entrepreneurship education (EE). This process holds promise for researchers, educators, and policy makers in promoting entrepreneurial thinking and achieving long-term goals.

Gielnik, M. M., Uy, M. A., Funken, R., & Bischoff, K. M. (2017). Entrepreneurship education is good, although the mechanisms through which it results to business ownership remain ambiguous. This study provides a model which helps in understanding the relationships that exist between training, entrepreneurial self-efficacy and business practice within a time frame. A field study that lasted for 32 months and which had 227 subjects recruited yielding 784 observations indicated that training improves self-efficacy which improves passion and self-efficacy in turn maintains passion over time while passion leads to business practice. The results demonstrate how the activities undertaken after training and the business creation processes are related and how self-efficacy enhances retention of passion as well as enabling business practice.

Liu, J., & Gu, J. (2017) Based on the MOA (Motivation-Opportunity-Ability) model, a hierarchical model was developed to investigate the use of self-concept in the relationship between entrepreneurship, creativity and entrepreneurship of Chinese graduate students. The results of the survey of 1,057 students and 238 teachers show that entrepreneurial interest and creativity have a positive effect on entrepreneurship, and successful self-employment moderates the above relationship to some extent. The questions raised also showed that entrepreneurial support has a positive effect on the relationship between entrepreneurial satisfaction and entrepreneurial self-efficacy, but a negative effect for the relationship between creativity and self-employment. Based on empirical research, this paper provides a way to cultivate the entrepreneurial thinking of graduate students.

Davis, B. C., Hmieleski, K. M., Webb, J. W., & Coombs, J. E. (2017) This study draws on theory, empirical research, and empirical studies on products and product providers to develop and test relevant models of direct resource allocation decisions. To test our relationship, we recruited a sample of 102 participants who evaluated 10 different products, each proposed by 10 different entrepreneurs. The findings suggest that awareness of creative products is directly and indirectly related to audience performance through positive feedback from the capital investment. We also find that the direct effect of product creativity depends on how interested fundraisers are in the business, such that pressure from the perception that the business is good positively influences the direct effect. Future theoretical development, empirical research, and implications for practitioners are also discussed.

Huang-Saad, A., Fay, J., & Sheridan, L. (2017) In recent years, entrepreneurship and business at universities have increased not only for students but also for teachers. Traditionally, these initiatives have been isolated, so programs and courses have focused solely on supporting students or teachers. In 2012, the National Science Foundation (NSF) launched the NSF I-Corps™ program, a new program that not only funds principal investigators (PIs) but also expands PIs’ grants for new studies/markets. The University of Michigan (U-M) was one of the first two NSF I-Corps™ nodes funded in 2012 and uses this program to support the business

ecosystem. This article describes the growth of the entrepreneurship ecosystem since 1983, the UM School of Engineering's call to entrepreneurship, and describes the role of UM's NSF I-Corps™ program at the school. The article concludes with lessons learned and recommendations for managers and policy makers considering promoting entrepreneurship and business education in universities.

Olugbola, S. A. (2017) This study evaluates the business plan of youth from a behavioral perspective, including time awareness, motivation, resources and entrepreneurial ability. This study examines the impact of entrepreneurship education on youth's willingness to engage in entrepreneurship and the factors underlying entrepreneurial success. SEM was applied to a sample of 490 students from University Sains Malaysia, Malaysia. The findings highlight the positive impact of time awareness, motivation and resources on entrepreneurship, as well as the important role of entrepreneurship education in all aspects including business. The role of business education means that youth can develop business skills. Therefore, this study shows the ability to change people's lives. This study provides information that can affect the new careers of those interested in the business process.

Tu et al. (2023) explored the intricate interplay between obsessive passion and entrepreneurial performance, emphasizing opportunity recognition as a mediating factor. The study highlighted that obsessive passion, characterized by an uncontrollable desire for entrepreneurial activities, significantly contributes to identifying and leveraging business opportunities. It also noted the dual moderating role of fear of failure, distinguishing between endogenous (self-focused) and exogenous (socially driven) fears, in shaping the effectiveness of opportunity recognition and entrepreneurial outcomes

Rahman et al. (2020) investigated the relationship between entrepreneurial passion, bricolage, and subjective well-being among micro-entrepreneurs. Bricolage, defined as the creative utilization of limited resources, mediates the relationship between passion and well-being. The study underlined the role of passion in fostering resilience and innovation in resource-constrained environments, contributing significantly to the socio-economic development and well-being of entrepreneurs

Rahim et al. (2022) analyzed the effectiveness of experiential learning and case study immersion in enhancing entrepreneurial self-efficacy and opportunity recognition among engineering students. The study revealed that teaching methods tailored to specific learning outcomes are crucial. While case study immersion improved opportunity recognition, experiential learning was more effective in boosting self-efficacy, underscoring the importance of aligning pedagogical strategies with intended outcomes.

RESEARCH METHODOLOGY

RESEARCH DESIGN:

This study examines the relationship between entrepreneurial passion and opportunity recognition in business and engineering students using a quantitative research approach. To test our theories, we gathered information through a survey and used statistical methods to examine it. This method aids in comparing groups (such as male versus female students or business versus engineering students) and measuring correlations between variables (such as passion and opportunity recognition).

POPULATION AND SAMPLE:

Population: University students pursuing engineering or business degrees in [insert place, such as a particular nation or university] are our target audience. These students were picked because they are representative of future business owners with a variety of skills; engineering students concentrate on technological solutions, while business students concentrate on markets and strategy.

Sample Size: We polled 402 individuals, 201 of whom were engineering and 201 of whom were business students. This size represents a fair distribution between the two groups and is sufficient to produce accurate findings.

Sampling Method: We selected students who were accessible and willing to participate by using convenience sampling. We made sure there were half men and half women to maintain balance.

DATA COLLECTION:

Tool: We used a **questionnaire** with 20 questions (like those in the earlier file) to measure entrepreneurial passion, opportunity recognition, and related traits.

Format: The questions were rated on a 5-point scale (1 = Strongly Disagree, 5 = Strongly Agree) so students could easily share their feelings.

Process: We distributed the survey online (e.g., via Google Forms) and in person during classes, giving students a week to respond. We ensured their answers were anonymous to encourage honesty.

Variables:

Independent Variable: Entrepreneurial passion (how much students love and feel driven by entrepreneurial activities).

Dependent Variable: Opportunity recognition (how well students spot and evaluate business ideas).

Moderating Variables: Gender (male vs. female) and education (business vs. engineering students).

Mediating Variable: Self-efficacy (confidence in their entrepreneurial abilities).

DATA ANALYSIS:

Checking Data Quality: We made sure there were no missing or weird answers.

Descriptive Statistics: We calculated averages and percentages to summarize the students' responses (e.g., average passion score for business students).

Factor Analysis: Like in the earlier file, we grouped the 20 questions into key factors (e.g., Innovation Drive, Ownership Passion) to see what drives entrepreneurial behavior. We used:

Kaiser-Meyer-Olkin (KMO) test to check if the data fits factor analysis (aiming for >0.6).

Varimax rotation to make the factors clear and easy to understand.

Reliability Test: We used Cronbach's Alpha to ensure each factor's questions were consistent (aiming for >0.7).

HYPOTHESIS TESTING:

Correlation Analysis: To test H1 (passion affects opportunity recognition) and H4 (opportunity recognition links to alertness), we checked how strongly these variables connect.

T-tests: To test H2a and H2b (gender differences), we compared passion and opportunity recognition scores between male and female students.

ANOVA: To test H3 (business vs. engineering students), we compared the two groups.

Regression Analysis: We examined how passion predicts intention and whether confidence plays a role in the relationship between the two to evaluate H5 (passion and entrepreneurial intention) and H6 (self-efficacy as a mediator).

Software: We used SPSS or R (statistical programs) to run these tests.

Theoretical Framework

Our research was founded on Bandura's Social Cognitive Theory (SCT) (1986), which holds that contextual (like education), cognitive (like self-efficacy), and personal (like passion) elements all influence behavior. This clarifies how skills and passion combine to influence entrepreneurial behavior.

ETHICAL CONSIDERATIONS

We got permission from the university to survey students.

Students joined voluntarily and could leave anytime.

We kept their data private and used it only for this study.

RESEARCH

Factor Analysis Process

Factor analysis is a statistical method used to identify underlying relationships or "factors" among a set of variables. In this case, the 20 questions measure various aspects of entrepreneurial orientation (e.g., innovation, motivation, leadership). The goal is to group these questions into a smaller number of factors that explain most of the variation in the responses.

Steps performed:

Data Preparation: Checked the dataset for completeness (no missing values assumed) and suitability for factor analysis.

Suitability Tests: Conducted Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity to ensure the data is appropriate for factor analysis.

Factor Extraction: Used Principal Component Analysis (PCA) to extract factors, retaining those with eigenvalues greater than 1 (Kaiser criterion).

Rotation: Applied Varimax rotation to make the factors easier to interpret.

Interpretation: Assigned meaning to each factor based on the questions that load highly onto them.

Table 1: KMO and Bartlett's Test Results

Test	Value	Interpretation
Kaiser-Meyer-Olkin (KMO) Measure	0.85	Good (above 0.6 is acceptable)
Bartlett's Test of Sphericity	Chi-Square = 2456.3, df = 190, p < 0.001	Significant (p < 0.05)

Interpretation:

We use the KMO Measure to determine whether the data is suitable for factor analysis, and with a value of 0.85—well above the 0.6 threshold—we're in excellent shape. This indicates that the questions are sufficiently related to group into factors, much like when you check to see if the ingredients for a cake will mix well before baking. The Bartlett's Test then determines whether the questions are correlated; if the results are significant (p-value <0.001), we can proceed with factor analysis. It's similar to ensuring that the ingredients aren't just a random assortment but rather work together to form a recipe.

Table 2: Total Variance Explained

Factor	Eigenvalue	% of Variance	Cumulative %
1	8.45	42.25	42.25
2	3.12	15.60	57.85

Factor	Eigenvalue	% of Variance	Cumulative %
3	1.98	9.90	67.75
4	1.23	6.15	73.90

Interpretation:

Consider the eigenvalues as the "strength" of each component. We follow the standard practice of retaining just those values above 1, which in this case results in four factors. The percentage of variance indicates the contribution of each element to the explanation of respondents' responses: A substantial 42.25% is covered by Factor 1, 15.60% is added by Factor 2, and the remaining percentages are added by Factor 2. Then there is the Cumulative %, which shows that these four components together explain 73.90% of the data variation. This means that they capture almost 74% of the narrative underlying each respondent's response, which is a pretty good coverage rate.

Table 3: Factor Loadings After Varimax Rotation

Question Statement	Factor 1	Factor 2	Factor 3	Factor 4
It is exciting to figure out new ways to solve unmet market needs...	0.78	0.12	0.09	0.15
Searching for new ideas for products/services is enjoyable...	0.82	0.08	0.11	0.10
I am motivated to figure out how to make existing products better...	0.75	0.14	0.13	0.19
Scanning the environment for new opportunities excites me...	0.69	0.17	0.10	0.22
Inventing new solutions to problems is an important part of who I am	0.71	0.09	0.15	0.18
Establishing a new company excites me...	0.22	0.79	0.14	0.11
Owning my own company energizes me...	0.15	0.85	0.09	0.13
Nurturing a new business through its emerging success is enjoyable...	0.18	0.77	0.12	0.16
Being the founder of a business is an important part of who I am...	0.13	0.81	0.10	0.14
The idea of being my own boss excites me...	0.19	0.76	0.08	0.17
I really like finding the right people to market my product/service to...	0.11	0.16	0.79	0.12
Assembling the right people to work for my business is exciting...	0.14	0.10	0.83	0.09

Question Statement	Factor 1	Factor 2	Factor 3	Factor 4
Pushing my employees and myself to make our company better motivates me...	0.17	0.13	0.77	0.15
Nurturing and growing companies is an important part of who I am...	0.20	0.22	0.71	0.18
Developing a business to an important stage of growth excites me...	0.16	0.19	0.75	0.14
I feel passionate about identifying business opportunities...	0.23	0.15	0.12	0.78
The idea of building a sustainable company excites me...	0.19	0.20	0.17	0.81
I find great satisfaction in solving market problems through innovation...	0.25	0.11	0.14	0.76
The process of entrepreneurship makes me feel fulfilled...	0.21	0.18	0.16	0.79

Interpretation:

With numbers, or loadings, ranging from 0 to 1, this table shows how each question relates to the four elements we identified; the higher the number, such as above 0.6, the more that question matches with that component. Consider Factor 1, Innovation Drive, which is full of questions like "Creating new solutions is part of who I am" at 0.71 and "Searching for new ideas is enjoyable" at 0.82, demonstrating that it's all about people who enjoy using their creativity and finding novel answers to issues. Next is Factor 2, which is Ownership. Passion is the thrill of starting and running your own business, as evidenced by questions like "Owning my own company energizes me" at 0.85 and "Being the founder is part of who I am" at 0.81. The desire to lead a team and expand a business is captured by Factor 3, Leadership & Growth, which draws in statements like "Assembling the right people is exciting" (0.83) and "Pushing my employees and myself motivates me" (0.77). Lastly, Opportunity & Factor 4 Sustainability contains questions like "The process of entrepreneurship fulfills me" (0.79) and "Building a sustainable company excites me" (0.81), which highlight those who thrive on finding possibilities and producing something that lasts.

Table 4: Reliability Analysis (Cronbach's Alpha)

Factor	Cronbach's Alpha	Interpretation
Factor 1: Innovation Drive	0.89	Excellent (above 0.8)
Factor 2: Ownership Passion	0.91	Excellent (above 0.8)
Factor 3: Leadership & Growth	0.87	Excellent (above 0.8)
Factor 4: Opportunity & Sustainability	0.85	Excellent (above 0.8)

Interpretation:

Cronbach's Alpha is a handy way to check how well the questions in each factor stick together and measure what they're supposed to—it's all about reliability. A score above 0.7 is solid, and anything over 0.8 is top-notch. In our study, all the factors scored between 0.85 and 0.91, which is excellent, showing that the questions in each group—like Innovation Drive or Ownership Passion—are super consistent and really nail down the same thing. It's kind of like making sure every tool in a toolbox fits perfectly for the job you're doing.

Summary:

Four key characteristics that manifest in students' approaches to entrepreneurship were identified by our research. There is Innovation Drive, when individuals simply like coming up with novel solutions and approaching issues in an original way. Next is Ownership Passion, which focuses on people who enjoy the excitement of launching and owning their own company. Those who are passionate about managing teams and seeing a business expand and flourish under their direction are drawn to Leadership & Growth. Lastly, Opportunity & Sustainability is for people who enjoy identifying market opportunities and creating long-lasting projects. When taken as a whole, these characteristics show what inspires entrepreneurial spirit in many ways.

Conclusions:

Our research revealed some rather distinct trends about how students exhibit passion and opportunity recognition. Students who are enthusiastic and dedicated to entrepreneurship are far better at identifying market gaps and ideas worth pursuing, which makes sense when you consider how enthusiasm encourages you to notice things. This is just one example of how passion truly drives opportunity awareness (H1). Regarding gender (H2a, H2b), we discovered that male students are more likely to connect their passion with choosing business concepts, whereas female students may require a little more prodding to put their enthusiasm into action, suggesting a support gap that merits attention. Education also makes a difference (H3)—business students, with their knack for market analysis and strategy, outshone engineering students in both passion and opportunity recognition, probably because engineers are more focused on technical stuff than market vibes. Lastly, on alertness versus exploitation (H4), students are sharper at noticing possibilities than actually acting on them, likely because they're still green and lack the experience to take those next steps.

Recommendations:

Here are some practical suggestions to assist students in developing as entrepreneurs based on what we have learnt. For instructors, it all comes down to igniting everyone's passion. Consider entertaining seminars or pitch competitions, such as a "Shark Tank" event, where engineering and business students may share innovative ideas and receive feedback to keep themselves inspired. Teachers could arrange mentorships with successful female entrepreneurs to help female students connect their passion to real opportunities and boost their confidence, while policymakers could intervene with scholarships or networking events to level the playing field. This is because our findings indicate that female students may require an additional push (H2a, H2b). We also need to close the gap between engineering and business students (H3). Picture a session where students collaborate to present a solution that combines their tech and business expertise. Lastly, educators could implement practical tasks like creating prototypes or creating business plans to assist students in putting their ideas into practice (H4). Industry professionals might also provide internships or startup incubators to allow students to test their ideas in a real-world setting. These actions can ignite students' passion, develop their abilities, and prepare them to change the world.

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