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# Linking University Students' Green Entrepreneurial Start-up Ideas with Enterprise Decision-Making: A Hybrid GANTT-EFAS-Fuzzy AHP-TOPSIS Framework

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**Abstract**

This study proposes an integrated multi-criteria decision-making framework combining GANTT, EFAS, Fuzzy AHP and TOPSIS to select green entrepreneurial start-up ideas proposed by university students and to extend their applicability to enterprise-level decision-making. Data were collected from 1,000 students at 50 public and private universities in Hanoi. The evaluation system comprises 13 green assessment criteria covering economic, market, resource feasibility and sustainability dimensions. EFAS is used to analyze the external environment, Fuzzy AHP is employed to determine criterion weights under uncertainty, and TOPSIS is applied to rank four groups of ideas: commerce, services, agriculture-forestry-fisheries, and manufacturing. The results indicate that commerce receives the highest priority, followed by services, agriculture, and manufacturing. This pattern reflects the suitability of low-investment, flexible and market-accessible business models under resource-constrained conditions. The study provides practical implications for enterprises in selecting investment directions, optimizing resources and mitigating risks. It also contributes by linking student-based idea evaluation with enterprise-level decision-making.

**Keywords:** Green Entrepreneurship, Green Entrepreneurial Start-Up Ideas, GANTT Model, EFAS Matrix, Fuzzy AHP-TOPSIS Model, Enterprise Decision-Making, University Students

## Introduction

In the context of green economic development, the selection of green entrepreneurial start-up ideas has become increasingly important for university students, who represent a potentially innovative and creative force. However, this selection process is affected by multiple criteria, including economic, market, feasibility and sustainability considerations, and therefore requires a systematic approach. At the same time, enterprises also face the challenge of selecting appropriate investment fields under constrained resources. This creates a need for a decision-support tool capable of connecting student-generated ideas with business practice. On this basis, the present study proposes an integrated GANTT-EFAS-Fuzzy AHP-TOPSIS model. Data were collected from 1,000 students from 50 universities in Hanoi. The findings provide a reference basis for students in selecting start-up ideas and for enterprises in orienting green business decision-making.

## Theoretical Background on the GANTT-EFAS-Fuzzy AHP-TOPSIS Model

The GANTT model is a project management tool developed by Henry L. Gantt in the early twentieth century. In this study, GANTT is used to construct the implementation roadmap for entrepreneurial ideas, thereby identifying the optimal execution time for each stage.

EFAS is a tool for analyzing external environmental factors, including opportunities and threats that affect business activities. In this study, EFAS is used to identify environmental factors influencing the selection of green entrepreneurial start-up ideas and to provide a basis for constructing the evaluation criteria system.

Fuzzy logic was first introduced by Zadeh (1965) [3]. This theory addresses problems in a way that closely resembles human reasoning. Instead of using exact values, assessments are expressed as triangular fuzzy numbers (l, m, u). In this study, fuzzy logic is integrated with AHP to transform qualitative judgments into quantitative forms, thereby improving the reliability of the

results.

AHP is a multi-criteria decision-making method developed by Professor Thomas L. Saaty in the 1970s. When combined with Fuzzy AHP, this method can process data under uncertainty, which is particularly suitable for evaluating business ideas.

TOPSIS is an alternative-ranking method based on the distance from the positive ideal solution (the best solution) and the negative ideal solution (the worst solution). The optimal alternative is the one closest to the positive ideal solution and farthest from the negative ideal solution. In this study, TOPSIS is used to rank groups of green entrepreneurial start-up ideas according to criteria whose weights have already been determined.

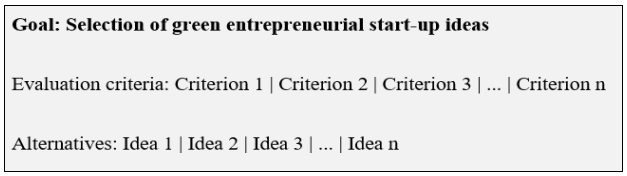
The integration of GANTT, EFAS, Fuzzy AHP and TOPSIS makes it possible to develop a comprehensive decision-making framework that combines environmental analysis, weighting, alternative ranking and implementation planning, thereby enhancing its applicability in both academic and enterprise settings.

## Research Methodology

This study adopts a quantitative approach combined with a multi-criteria decision-making (MCDM) model to select students' green entrepreneurial start-up ideas and to extend the application to enterprises. The research process is based on the integrated GANTT-EFAS-Fuzzy AHP-TOPSIS model. Data were collected through a survey of 1,000 students from 50 public and private universities in Hanoi. Based on these data, a system of 13 criteria for evaluating green entrepreneurial start-up ideas was developed, including: (TC1) green potential profitability, (TC2) green market share, (TC3) green competition level, (TC4) green consumer appeal, (TC5) green supply, (TC6) green economic efficiency, (TC7) green time, (TC8) green trend, (TC9) green location, (TC10) green value and innovation, (TC11) green actual demand, (TC12) green self-reliance capacity, and (TC13) green context.

In this study, the GANTT chart is used in the initial stage to determine the ideal average time required to implement entrepreneurial start-up ideas. This duration is calculated from survey data and reflects the appropriateness of implementation progress under practical conditions. On that basis, start-up ideas whose implementation time exceeds or does not fit the ideal time range are excluded from the set of research alternatives. After this initial screening, the EFAS model is used to analyze external environmental factors and guide the development of evaluation criteria. Next, Fuzzy AHP is applied to determine the weights of the criteria under uncertainty by converting qualitative assessments into triangular fuzzy numbers and using the geometric mean to synthesize judgments. Finally, TOPSIS is applied to rank the remaining alternatives and identify the optimal green entrepreneurial start-up idea.

## General Research Model




**Source:** Proposed by the authors.

**Fig 1.1:** Hierarchical structure of the research model

## Research Results

The survey results show that commerce is the dominant field, accounting for 53.8%. This field attracts the largest number of students in entrepreneurial activities. The service sector (24%) has room for expansion, including academic consulting, tutoring, phone repair, beauty services and similar activities. This sector is suitable for students with specialized skills or personal talents. Manufacturing accounts for 18.5%; although it is more difficult to initiate, it can generate higher value. Students who select manufacturing often demonstrate design, fabrication, processing, or creative craft-oriented thinking. Agriculture-forestry-fisheries accounts for only 3.7%. Although this field may have considerable potential, it is selected by relatively few students, largely because implementation requires land, natural resources and practical conditions, whereas students mainly study in urban areas and have limited opportunities for practice. The most common start-up ideas are opening a cake shop (10.9%) and selling clothes online (8.0%). The least selected ideas are opening a supermarket and opening a 3D printing/engraving shop (0.5%). Business ideas are concentrated mainly in commerce, services and retail. This indicates that students selected a diverse range of business ideas, extending from traditional fields such as food, clothing, cosmetics and tutoring to more modern and specialized fields such as 3D printing and engraving, medical therapy and essential-oil processing.

According to the GANTT-chart-based survey results, the ideal average time for exploration and idea formation is 1.9 months; market research requires an ideal average time of 2.1 months; business planning requires an ideal average time of 2.097 months; legal procedures and licensing require an ideal average time of 2.043 months; and marketing and brand development require an ideal average time of 2.2325 months. The average time interval for ideas selected for analysis in the EFAS matrix is [6.35; 14.29].

**Table 2:** Selected business lines within start-up fields

| Business field | Business category | Surveyed business lines selected for evaluation |
|---|---|---|
| Manufacturing | Food production | - Opening a cake shop<br>- Processing aromatic essential oils<br>- Selling yogurt and nut milk |
| Commerce | Traditional commerce | - Selling handmade products<br>- Opening a footwear store<br>- Trading sports equipment<br>- Trading electronic devices<br>- Opening a grocery store<br>- Trading jewelry accessories |

| | | |
|---|---|---|
| | | - Trading ornamental plants<br>- Trading ornamental fish<br>- Textile and garment store<br>- Opening a baby-products store<br>- Opening a furniture store<br>- Opening a building-materials store<br>- Opening a mobile-phone store<br>- Opening a souvenir/office-supplies store<br>- Selling electronic components<br>- Selling furniture<br>- Selling swimwear<br>- Selling medicinal herbs |
| | E-commerce | - Selling clothes online<br>- Selling cosmetics online<br>- Selling books online<br>- Online selling |
| Services | Education services | - Opening a cooking class<br>- Tutoring |
| | Health-care services | - Opening a hair salon<br>- Opening a spa/nail salon |
| | Marketing services | - Event organization company |
| | Food and beverage services | - Opening a beverage shop<br>- Opening a snack shop<br>- Restaurant business<br>- Selling snacks<br>- Opening a rice-meal shop<br>- Selling kimbap |
| | Design services | - Fashion design<br>- Custom painting services |
| | Entertainment services | - Photography services |
| Agriculture-forestry-fisheries | Cultivation | - Growing spice and medicinal plants |

**Source:** Authors' synthesis.

The EFAS matrix results indicate that the service sector records the highest total score, at 4.36, suggesting strong alignment with global sustainable-development trends and current green-consumption demand. Commerce obtains a total score of 3.68, indicating a relatively high level of benefit from green-consumption trends and policy support. However, it is affected by intense competition from larger competitors and by difficulties in accessing capital, especially in e-commerce or import-oriented models. Manufacturing records a total score of 3.46 and has potential, particularly when associated with technological innovation, green products and environmentally friendly materials. Nevertheless, it is vulnerable to start-up policies that do not yet strongly prioritize small-scale manufacturing. Agriculture-forestry-fisheries records a total score of 3.29. This field is strongly affected by limited access to market information and capital, negative impacts from climate change, and constrained capacity to apply new technologies in many small and fragmented models.

**Table 3:** EFAS matrix for evaluating four entrepreneurial start-up fields

| External factor | Weight | Commerce | Manufacturing | Services | Agriculture-forestry-fisheries |
|---|---|---|---|---|---|
| Sustainable-development trend | 0.10 | 0.40 | 0.30 | 0.40 | 0.30 |
| Support from government and organizations | 0.10 | 0.30 | 0.30 | 0.40 | 0.30 |
| Increasing demand for green products | 0.12 | 0.48 | 0.36 | 0.48 | 0.36 |
| Brand building and reputation | 0.08 | 0.24 | 0.24 | 0.32 | 0.24 |
| Innovation and technology | 0.10 | 0.30 | 0.40 | 0.40 | 0.30 |
| Consumer-market development | 0.08 | 0.24 | 0.24 | 0.32 | 0.24 |
| Smart-consumption trend | 0.07 | 0.21 | 0.21 | 0.28 | 0.21 |
| New technologies (AI, e-commerce, etc.) | 0.07 | 0.21 | 0.21 | 0.28 | 0.14 |
| Local start-up policies | 0.10 | 0.30 | 0.20 | 0.30 | 0.20 |
| Support from universities/incubators | 0.08 | 0.24 | 0.24 | 0.32 | 0.24 |
| Competition from large competitors | 0.10 | 0.20 | 0.30 | 0.20 | 0.20 |
| Difficulty in accessing capital | 0.10 | 0.20 | 0.20 | 0.20 | 0.20 |
| Lack of market information | 0.08 | 0.16 | 0.16 | 0.16 | 0.16 |
| Climate change and socio-economic conditions | 0.10 | 0.20 | 0.20 | 0.30 | 0.20 |
| **Total** | **1.00** | **3.68** | **3.56** | **4.36** | **3.29** |

**Source:** Authors' synthesis.

This study uses a 1-to-9 scale (Sodhi and Prabhakar, 2012) [4] to transform linguistic variables into fuzzy numbers. Five conversion intervals are selected to conduct pairwise comparisons among fuzzy parameters, as shown in Table 5.

**Table 5:** Linguistic variables and corresponding fuzzy numbers

| Linguistic variable | Variable symbol | Linguistic variable code | Corresponding triangular fuzzy numbers | Reciprocal triangular fuzzy numbers |
|---|---|---|---|---|
| Equally important | BN | 1 | (1,1,3) | (1/3,1,1) |
| More important | TH | 3 | (1,3,5) | (1/5,1/3,1) |
| Much more important | NH | 5 | (3,5,7) | (1/7,1/5,1/3) |
| Very important | RT | 7 | (5,7,9) | (1/9,1/7,1/5) |
| Extremely important | CT | 9 | (7,9,9) | (1/9,1/9,1/7) |

**Source:** Proposed by the authors.

The criterion groups are classified according to a logical structure to ensure consistency with the EFAS matrix. Green entrepreneurial start-up ideas are selected across four business fields. The manufacturing idea, commerce idea, service idea and agriculture-forestry-fisheries idea are denoted as YTSX, YTTM, YTDV and YTNLNN, respectively. The resulting normalized matrix is presented in Table 6.

**Table 6:** Weighted normalized matrix and PIS/NIS by criteria

| Criterion | YTSX | YTTM | YTDV | YTNLNN | A+ | A- | Rank |
|---|---|---|---|---|---|---|---|
| TC1 | 0.083 | 0.068 | 0.083 | 0.054 | 0.083 | 0.054 | 5 |
| TC2 | 0.059 | 0.059 | 0.052 | 0.041 | 0.059 | 0.041 | 4 |
| TC3 | 0.042 | 0.042 | 0.039 | 0.022 | 0.022 | 0.042 | 2 |
| TC4 | 0.046 | 0.046 | 0.043 | 0.022 | 0.046 | 0.022 | 10 |
| TC5 | 0.035 | 0.050 | 0.038 | 0.023 | 0.050 | 0.023 | 11 |
| TC6 | 0.023 | 0.046 | 0.052 | 0.011 | 0.052 | 0.011 | 12 |
| TC7 | 0.018 | 0.041 | 0.034 | 0.011 | 0.011 | 0.040 | 1 |
| TC8 | 0.017 | 0.040 | 0.039 | 0.019 | 0.040 | 0.017 | 8 |
| TC9 | 0.019 | 0.036 | 0.041 | 0.020 | 0.041 | 0.019 | 6 |
| TC10 | 0.020 | 0.040 | 0.040 | 0.020 | 0.040 | 0.020 | 9 |
| TC11 | 0.024 | 0.040 | 0.041 | 0.016 | 0.041 | 0.016 | 7 |
| TC12 | 0.009 | 0.030 | 0.030 | 0.020 | 0.030 | 0.009 | 13 |
| TC13 | 0.020 | 0.032 | 0.032 | 0.018 | 0.018 | 0.032 | 3 |

**Source:** Research results of the authors.

The ranking results show that green time (TC7) has the highest priority, reflecting the important role of implementation progress in selecting entrepreneurial start-up ideas. It is followed by criteria related to competition level (TC3) and green context (TC13), indicating that market and external environmental factors have a substantial influence on the feasibility of an idea. Criteria such as green market share (TC2), green potential profitability (TC1) and green location (TC9) have a moderate level of influence, reflecting a balance between economic efficiency and market access. Meanwhile, criteria such as green economic efficiency (TC6) and green self-reliance capacity (TC12) receive lower priority. This suggests that, in the start-up stage, speed of implementation and market conditions are prioritized over internal capacity.

From the enterprise perspective, these results indicate that investment decisions should prioritize projects with rapid implementation timelines and strong fit with the market context in order to reduce risks and increase adaptability. At the same time, competition and the business environment should be considered carefully to ensure practical feasibility. This confirms that the model is not only suitable for students but can also support enterprises in selecting and prioritizing green business alternatives.

Based on the closeness coefficient results, the commerce idea (YTTM) is the optimal choice for students pursuing green entrepreneurial start-ups, with CCi = 0.692. The service idea (YTDV) and the agriculture-forestry-fisheries idea (YTNLNN) reach a medium level of suitability (CCi = 0.500) and may be considered by students. By contrast, the manufacturing idea (YTSX) ranks last with the lowest CCi value (0.464), indicating limited start-up accessibility and the need to adjust input factors if the feasibility of this group of ideas is to be improved.

**Table 7:** Priority ranking of green entrepreneurial start-up ideas by field

| Order | Entrepreneurial start-up field |
|---|---|
| 1 | Commerce idea |
| 2 | Service idea |
| 3 | Agriculture-forestry-fisheries idea |
| 4 | Manufacturing idea |

**Source:** Proposed by the authors.

From the enterprise perspective, these findings are important for supporting decisions on investment-field selection, particularly during the initial establishment or expansion of business activities. Specifically, enterprises may prioritize projects in commerce and services in order to leverage flexibility and market accessibility, thereby reducing risks and optimizing resources. Conversely, although manufacturing has long-term potential, it requires larger resources and longer implementation periods, and therefore should be carefully considered under resource-constrained conditions.

Accordingly, the findings are meaningful not only for students in orienting their selection of entrepreneurial start-up ideas, but also as a useful reference tool for enterprises in green business investment decision-making.

**Solutions for Improving the Effectiveness of Green Entrepreneurial Idea Selection and Implications for Stakeholders**

**1. For students**

First, students should prioritize ideas with an appropriate implementation time (TC7) to ensure feasibility under limited resource conditions.

Second, they should carefully analyze the level of green competition (TC3) and the green context (TC13) to improve the feasibility of their ideas.

Third, idea selection should be linked to green actual demand (TC11) and green consumer appeal (TC4) in order to increase market accessibility.

Fourth, students should pay attention to green market share (TC2), green trends (TC8), and green value and innovation (TC10) to ensure long-term development potential.

**2. For enterprises**

First, enterprises should prioritize projects with short implementation periods (TC7) and good fit with the green market context (TC13) in order to reduce investment risks.

Second, they should carefully assess the level of competition (TC3) and green potential market share (TC2) when

selecting investment directions.
Third, investment decisions should be based on green potential profitability (TC1) and green economic efficiency (TC6) to ensure financial sustainability.
Fourth, enterprises should take advantage of green trends (TC8), market demand (TC11), and green innovation (TC10) to enhance competitiveness.

**3. For universities and start-up support centers**
First, training programs should be developed in connection with practical implementation capacity (TC7) and self-reliance capacity (TC12) in order to improve students' entrepreneurial skills.
Second, business-context analysis (TC13) and competition analysis (TC3) should be integrated into teaching in order to strengthen market adaptability.
Third, support activities should focus on developing ideas aligned with actual demand (TC11) and consumer appeal (TC4).
Fourth, linkages with enterprises should be strengthened so that students can access factors related to market share (TC2), supply (TC5), and implementation location (TC9).
In conclusion, the proposed solutions are developed on the basis of the ranking results for 13 criteria, thereby ensuring consistency between the quantitative model and practical implications. They also contribute to improving the effectiveness of green entrepreneurial idea selection and supporting enterprise decision-making.

**References**
1. Bennane MEA, Labbi A. Fuzzy similarity TOPSIS variants for ecopreneur selection. Procedia Computer Science. 2017; 121:623-630.
2. Gantt HL. Work, Wages, and Profits: Their Influence on the Cost of Living. New York: Engineering Magazine Company, 1910.
3. Zadeh LA. Fuzzy sets. Information and Control. 1965; 8(3):338-353.
4. Sodhi MS, Prabhakar A. AHP-Fuzzy approach for evaluating service quality in academic libraries. International Journal of Productivity and Quality Management. 2012; 10(4):519-540.
5. Kerzner H. Project Management: A Systems Approach to Planning, Scheduling, and Controlling (12th ed.). Hoboken, NJ: John Wiley & Sons, 2017.
6. Saaty TL. The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation. New York: McGraw-Hill, 1980.
7. Shahi A, Pourjavad E. A fuzzy multi-criteria decision-making approach for evaluating green supplier development programs (GSDP). Journal of Cleaner Production. 2020; 244:118766.
8. Wijayanti WR, Dewi WR, Ardi F. The integration of fuzzy AHP and TOPSIS methods to evaluate the service quality of e-commerce websites. Journal of Theoretical and Applied Information Technology. 2018; 96(13):4065-4073.
9. Hwang CL, Yoon K. Multiple Attribute Decision Making: Methods and Applications. New York: Springer-Verlag, 1981.