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A Neutrosophic Study of the Advancement of Entrepreneurial Projects and Technological Innovations as a Resource for Competitive Strengthening

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Abstract

This article addresses a core problem in the entrepreneurial field: how technological innovations can boost the development of emerging projects and strengthen their competitiveness in a volatile business environment. The central question guiding this research seeks to clarify the role of cutting-edge technological tools in the growth of entrepreneurial initiatives, considering both their advantages and associated uncertainties. Although the literature has explored the relationship between technology and entrepreneurship, there is a glaring gap: traditional approaches often overlook the ambiguity inherent in human perceptions and the dilemmas that arise when adopting technological advances. To overcome this limitation, the study employs the neutrosophic Delphi method, a technique that integrates uncertainty and the divergent opinions of experts, providing a more in-depth and balanced analysis. Through iterative rounds of neutrosophic consultation and processing, key aspects such as accessibility, adaptability, and technological risks are assessed. The relevance of this topic is evident in its capacity to influence the survival and success of new ventures in saturated markets, where technology stands as a key differentiating factor. The results show that the neutrosophic approach reveals nuances hidden from conventional methods, highlighting that innovations not only enhance entrepreneurial advancement but also pose significant strategic challenges. The study's contributions are twofold: theoretically, it introduces an innovative framework for analyzing complex systems under uncertainty; practically, it offers clear guidelines for entrepreneurs to optimize their competitive positioning, balancing technological benefits and challenges. This work not only expands academic knowledge on the intersection between technology and entrepreneurship but also provides applicable tools to strengthen the resilience of emerging projects, underscoring the need for flexible and well-informed approaches in a constantly changing global context.

Keywords: Entrepreneurship; Technological Innovations; Competitiveness; Neutrosophic Delphi Method; Uncertainty; Entrepreneurial Projects; Development.

1 | Introduction

Entrepreneurship plays a key role in a nation's economic progress, as the entrepreneur's inventiveness allows them to conceive something new or transform the use of something pre-existing, thus generating a positive impact on both their existence and the social environment. Economic challenges and fierce competition in



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the business world constitute significant obstacles. In this context, technology emerges as a transformative resource that optimizes data management and facilitates the achievement of goals set by entrepreneurs in various sectors. Technology is indispensable for any organization today, essential for entrepreneurs to remain competitive in a globalized and demanding market. There is an inseparable connection between business operations and technological advances, which lead to savings in time and costs. Any entrepreneur who resists venturing into the digital realm runs the risk of becoming trapped in a state of obsolescence and disconnection, where realizing their business vision becomes slower and more complex compared to those who leverage technological solutions.

This study is organized around a theoretical framework that covers definitions, features, relevance, advantages, and influences of entrepreneurship and technology, complemented by an analysis and conclusions that seek to enrich the reader's understanding of the importance of these two dimensions in the economy. This technology as the set of instruments created by human beings, either as practical means to achieve a purpose or as the sum of tangible objects. In addition, it covers functional practices such as the invention, production and use of tools and devices, integrating both the material and intangible aspects of technical facts since the time of Aristotle [1].

Technology is composed of four fundamental elements: the base material from which the technical device is constructed; its configuration or design; its intended purpose or use; and the effective intervention of the creator who brings the tools to life. Its characteristics include:

- Specialization: the greater the technological development, the greater the degree of specialization required.
- Integration: Adapting to a technologically advanced society is more complex than to one with less technical progress since it involves more intricate systems.
- Discontinuity: Technological progress is defined by disruptive advances and not by constant evolution.
- Change: Technological advances bring with them parallel social transformations, demanding adaptation to new realities, sometimes so rapid that they generate dilemmas before answers are found.

In essence, technology satisfies both individual and collective demands, playing multiple roles in everyday life. It facilitates the resolution of specific problems, enables the creation of goods or services, and fosters adaptation to the environment, thus transforming human interaction with the world.

2 | Materials and Methods

Was used to enable the analysis of the qualitative components of the undertaking, combined with multicriteria methods through weighting to determine alternatives. It was conceived by the authors used ordering and aggregation methods to establish the viability of the proposal. Within the methods Multicriteria classics the was handled weighing linear. The method consisted of calculating an overall score r_i for each alternative A_i as expressed in the discussion.

2.1 | Some Definitions Basics

According to Formichella [2] in his work *Concept of Entrepreneurship and its Relationship with Education, employment and Local Development**, it is stated that being an entrepreneur implies having the ability to originate something innovative or to reorient the use of something pre-existing, thus managing to influence both personal life and that of the surrounding community. This type of person not only conceives ideas but also demonstrates a remarkable adaptability to adjust them according to the circumstances, in addition to having enough inventiveness to turn each situation, whether favorable or adverse, into an opportunity for growth (p. 4).

The entrepreneur is distinguished by a unique character. He or she possesses high self-esteem, a strong belief in his or her abilities, and an intense motivation to achieve goals. He or she works hard, acts effectively, and

allows himself or herself to explore different approaches. His or her optimistic attitude is not limited to his or her benefit; it also fosters a positive climate in his or her surroundings, which helps him or her move toward the goals he or she sets for himself or herself. One aspect worth highlighting is that the entrepreneur does not conceive his or her initiative in a narrow sense, but always looks to the future, thinking about the long-term impact.

2.2 | Features of the Entrepreneurship

For numerous entrepreneurs and business initiatives to emerge, a set of recurring qualities are required, which experts agree are essential. These qualities are not exclusive to our era but have been present, to a greater or lesser extent, throughout different periods of history. Among these, two key elements stand out: knowledge, which, when intertwined with other areas of knowledge and fused, gives rise to the creation of extraordinary and surprising projects; and inventiveness combined with originality, which drives the development of products, methods, and lifestyles capable of transforming societies, leading them toward more advanced forms of coexistence, higher standards of living, and more efficient use of resources [3]. Furthermore, entrepreneurship entails facing a series of challenges, which demands an optimistic attitude and a strong determination to overcome difficulties. In this sense, an outstanding entrepreneur must also be distinguished by their tenacity, versatility, and ability to adapt to the environment in which they operate.

2.3 | Importance of the Entrepreneurship

Perera [4] indicates that entrepreneurship has to be studied for ease and explain the paper of the new business in economic development, entrepreneurship is important because of its understanding:

- Enables the creation of jobs, inclusive of self-employment.
- Enables growth economic of organized form.
- Enables innovation, mainly by the young companies.
- Help in the improvement of competitiveness.
- Take advantage better the potential of the individuals.
- Allows understanding and exploration of more forms effective the interests of society.
- Allows the development of a career significant part of the force of work.

Entrepreneurs must think like businesspeople, because any venture will have to develop, at one point or another, through a company. That's why they must think like businesspeople from the very beginning. Thinking like a businessperson means doing things right from the start, from formality in all administrative procedures to dealing with teams, suppliers, customers, etc.

2.4 | Definition of Entrepreneur Technological

The tech entrepreneur can take advantage of the resources that exist on the Internet so that your company gets ahead, even without having to make a large investment [5]. However, anyone looking to undertake it needs to know if what they are doing is wants do has a market if someone would pay for that, or if someone with more money and in less time could do something similar.

2.4.1 | The TIC In its Business Environment

Information and Communications Technologies (ICT) are an excellent business management tool that positively contributes to the development and viability of organizations. ICT adds value to operational and business management activities in general and allows companies to gain competitive advantages, stay in the market, and focus on their business [6].

2.4.2 | Technology for Entrepreneurship

According to Grandón [7], globalization, along with technological advances, has managed to shorten distances, reduce cultural gaps, and also improve economies and businesses. In this way, entrepreneurs have taken advantage of easy access to new digital tools to boost their businesses and reach new customers, who go from local to national and even often international.

Along these lines, the arrival of ICT (Information and Communication Technologies) has also allowed stores to become digital, and sellers to become producers, managers, and advertisers of their brands. Nowadays, a store or office can be simply a mobile phone, making it easy to serve customers from anywhere in the world. Communication has become efficient, thanks to platforms like Facebook, Twitter, WhatsApp, and even pages online sales. In this way, technology and entrepreneurship come together to invite entrepreneurs to develop innovative and creative processes that allow for improving, reducing costs, and optimizing their resources.

2.4.3 | Benefits of the Tic For the Companies

- Opening of markets at a global level thanks to the implementation and advantages of electronic commerce (e-commerce).
- New models business and in the relationship with the client.
- Service automation and processes inmates and external.
- Important savings of costs.

2.5 | Importance of Technology In Entrepreneurship

Technology has a huge impact on business operations. No matter the size of your business, technology can help. Many benefits that tea will help to earn higher incomes. The major role of technology in the business is to drive growth and improve operations. Without the technology, companies are almost certain to fail to stay afloat in today's competitive and globalized marketplace [8].

Many years ago, no one knew exactly how or why, man discovered "cooking." He discovered that by heating his food before eating it, he consumed it in less time and made better use of it. We need less strength to chew and less time to digest. Cooking gave us jaws and artificial stomachs that provided a head with the space and nutrients required to develop the human brain.

Cooking was our first technology and it was what made us human. I imagine some prefer to eat all their food raw, but I bet they are few. The benefits of using technology kitchen, exceed the of no do it. It same happens with contemporary technology, as, by example, Smartphones.

Today, smartphones give us an external brain. The benefits of having a phone that works quickly and always outweigh its cost. However, many entrepreneurs don't think technology is essential for starting a business. And perhaps they're right. It's not essential to cook meals, nor is it essential to use Uber to get around in someone else's car. However, eating and getting around are much more efficient with technology. We do more with less. So, why start a business without technology?

I think it's due to impatience. I don't think you'd prefer to start a business without technology. The thing is, developing it is incredibly difficult and requires a huge amount of effort. It requires hundreds, and thousands of hours to identify your business processes and translate them into words, formulas, and drawings. You think (rightly) that the most urgent thing is to sell, and you think (wrongly) that you don't have time to break down procedures, Excel spreadsheets, and checklists that you'll have to automate one day so that in the future your startup won't depend on you to produce its products and provide service.

Keep calm and keep at it. All this effort is worth it. By developing technology, you are creating passive income, an income you will receive for your past efforts (as opposed to your active income, which you generate through your present effort — your sales, your salary).

Without a doubt, your priority is to sell, to find a viable solution to the problem you have solved. But you can also dedicate time to developing technology now.

3 | Results and Discussion

Impact of Technology in Entrepreneurship. According to Baptista [9], if one has a good level of technological knowledge, is there a greater chance that an idea/business will develop better? Without a doubt, having a good level of technological knowledge is scoring a few points in the entrepreneurship race. However, I believe that, like everything, is essential to balance the fronts, and what I mean by this, is that technology can become sterile if not accompanied by a series of capabilities and skills that are practically imperative for an entrepreneur.

3.1 | Evaluation Neutrosophic of the Development of Entrepreneurship and the New Technologies as Strategic Positioning

For the resolution of issues of take of decisions, various they have been the methods of multi-criteria proposals [10, 11]. When a weighting is desired for a given alternative, the ordering and aggregation methods represent a viable way for its application [12-14]. Within the classic multi-criteria methods linear weighting is found. The method consists of calculating a global score r_i for each alternative A_i as expressed in Eq. (2) [15-18].

$$R_i = \sum_j w_j r_{ij} \quad (1)$$

Linear weighting represents a compensatory method, it is applied after a previous normalization. His method is applied in cases where one has a set m of alternatives and n criteria [19-21]. For each criterion j , the decision-maker estimates each alternative i . The evaluation a_{ij} is obtained from the decision matrix that has a cardinal ratio weighting. A weight W_j is assigned ($j=1, n$) also of the cardinal ratio type for each of the criteria C_j .

In the context of multi-criteria methods, neutrosophic numbers are introduced to represent neutrality [22, 23]. They form the basis of mathematical theories that generalize classical and fuzzy theories such as Neutrosophic sets and neutrosophic logic [24-26]. A neutrosophic number (N) is represented as follows [27, 28]:

$N = \{ (T, I, F) : T, I, F \subseteq [0, 1] \}$, a neutrosophic valuation is a mapping of a group of formulas proportional to N , that is, for each sentence p we have [29-36]:

$$v(p) = (T, I, F) \quad (2)$$

Where:

- T : represents the dimension of the space that represents the truth
- I : represents falsehood
- F : represents the indeterminacy.

Mathematically it can be defined as a method of Linear Weighting Neutrosophic as a 3-tuple (R, W_r) as represented by Eq. (4).

$$R_{(T,I,F)} = \sum_j w_j r_{ij(T,I,F)} \quad (3)$$

where:

- $R_{(T,I,F)}$: represents the resulting function that refers to a dimension of the truth, falsehood, and indeterminacy space (T, I, F) .

- $W_{(T,I,F)}$: represents the weight of criterion j associated with the criteria that refer to a dimension of the space truth, falsehood, and indeterminacy (T, I, F) .
- τ_{ij} : represents the assessment of the alternative i regard to the criterion j that refers to a dimension of the truth, falsehood, and indeterminacy space (T, I, F) .

Stage 1. The ID of the criteria for assessing the development of ventures and new technologies as strategic positioning

For the analysis and operation of the proposed method, 9 were used criteria for the development of entrepreneurship mints and new technologies as strategic positioning as presented in Table 1.

Table 1. Criteria for measuring the development of ventures and the new technologies as positioning strategic.

No	Criteria
1	Planning
2	Determination
3	Vision
4	Constancy
5	Self-knowledge
6	Resilience
7	Flexibility
8	Creativity
9	He good do

Stage 2. Determination of the weights.

For the stage of determining the weights assigned to the criteria, five experts were consulted, who provided their assessments of the criteria. The evaluation tables were obtained and aggregated into a resulting table using the neutrosophic numbers defined in Table 2.

Table 2. Linguistic terms used.

Linguistic term	Numbers SVN
Extremely high (EB)	[1,0,0]
Very very high (MMB)	[0.9, 0.1, 0.1]
Very high (MB)	[0.8,0.15,0.20]
High (B)	[0.70,0.25,0.30]
Moderately high (MDB)	[0.60,0.35,0.40]
Media (M)	[0.50,0.50,0.50]
Moderately low (MDM)	[0.40,0.65,0.60]
Low (MA)	[0.30,0.75,0.70]
Very low (MM)	[0.20,0.85,0.80]
Very very low (MMM)	[0.10,0.90,0.90]
Extremely low (EM)	[0,1,1]

Table 3 shows the result of the assessment of the criteria once carried out on the aggregation process.

Table 3. Weight attributed to the criteria to leave the consultation to experts.

Criteria	Assessment of the criterion $W_{(T,I,F)}$
C 1	[1,0,0]
C 2	[1,0,0]
C 3	[0.70,0.25,0.30]
C 4	[0.9, 0.1, 0.1] [1,0,0]
C 5	[0.9, 0.1, 0.1]
C 6	[0.9, 0.1, 0.1]

C 7	[0.8,0.15,0.20]
C 8	[0.9, 0.1, 0.1]
C 9	[0.8,0.15,0.20]

Stage 3. Neutrosophic developmental assessment of entrepreneurship and new technologies as strategic positioning

From the behavior of the weights attributed to the alternatives and the development of the criteria defined, the degree of belonging of each criterion to the case study is determined by an aggregation process. Table 4 shows the result of the calculation performed.

Table 4. Prosecution of the system of making decisions.

Competencies	Weights $\mathbf{W(T,I,F)}$	Preferences	$\mathbf{Rt(T,I,F)}$
C 1	[1,0,0]	[1,0.10,0.15]	[1,0.10,0.10]
C 2	[1,0,0]	[1,0.10,0.15]	[1,0.10,0.10]
C 3	[0.70,0.25,0.30]	[0.75,0.10,0.15]	[0.52,0.10,0.15]
C 4	[0.9, 0.1, 0.1]	[0.75,0.10,0.15]	[0.67,0.35,0.40]
C 5	[0.9, 0.1, 0.1]	[0.50,0.10,0.15]	[0.45,0.10,0.15]
C 6	[0.9, 0.1, 0.1]	[0.75,0.10,0.15]	[0.60,0.35,0.40]
C 7	[0.8,0.15,0.20]	[0.75,0.10,0.15]	[0.60,0.35,0.40]
C 8	[0.9, 0.1, 0.1]	[1,0.10,0.15]	[0.9, 0.1, 0.1]
C 9	[0.8,0.15,0.20]	[1,0.10,0.15]	[0.8,0.15,0.20]
Index			[0.72,0.10,0.15]

For the case of analysis, an index of 0.72 is evident, which represents a high index for the development of entrepreneurship and new technologies as a strategic positioning. The entrepreneur who does not allow himself to enter the technological world risks remaining in a limbo of isolation and outdatedness in which carrying out his business idea is not as simple and fast as having technological means.

3.2 | Tools Technological Further used in the Companies

Technological tools can be used in different ways in organizations. Some are designed to support administrative processes, while others are essential for the organization of operations and the management of the company as a whole. Among the most commonly used are the following:

Systems of Planning of Business Resources

Known as ERPs, for their acronym in English, Enterprise Resource Planning. These are management information systems, which are characterized by integrating and managing the businesses associated with the operations of production and distribution of a company.

Customer Relationship Management (CRM)

It is an application capable of managing and administering everything related to the client's processes, which includes everything from sales to interaction with the marketing area. Through it, you can easily understand customers' needs and purchasing habits.

Dropbox

This treats of a service for hosting files cross-platform in the cloud, it is widely used in companies to store, share, and transfer information online and between computers, and Dropbox provides a secure cloud space for business files.

Hangout or Skype

They are tools widely used in companies to improve internal communication and hold meetings remotely. This way, companies do not have to travel anywhere, since with these applications they can hold a video conference from the comfort of their home or office.

The use of tools in business management has facilitated collaborative work among system users and improved the development of administrative management within a business entity.

3.3 | Input of the Technology to Entrepreneurship

Technology plays an extremely important role in almost every area of our lives, it has been capable of transforming the style of life of the beings humans in such a manner that it would be difficult to imagine a day without her.

At the business or entrepreneurial level, technological resources have become a vital tool that generates a wide range of benefits for those who know how to take advantage of them, but how necessary are technologies in those growing companies that are just beginning to venture into their respective industries?

Taking into account the dynamics accelerated market, this type of business needs more than ever to invest in technologies and development teams that allow them to improve each of their processes, provide more value to the organization to develop at a level equal to or greater than that of their competitors, and thus achieve greater market share.

As aid the technology to entrepreneurship for grow and compete?

The growth of the standards world of quality, how HE moves the business, and the Access to information by consumers, among other factors, has forced growing entrepreneurs to acquire infrastructure and technological tools that allow them to compete in the knowledge economy and help them transform their product and service offerings to grow and compete.

Investing in resources allows to the entrepreneur rethink and integrate their processes, reduce costs, improve communications, transform business processes, and implement a strong culture, Technologies are here to stay, and they have become an alternative to reinventing small and medium-sized businesses.

Partners are now easier thanks to platforms like email, Skype, FaceTime, and others. Technology has significantly reduced investment in business travel.

Even technology has put on the entrepreneurial menu the option of a series of trade channels such as social networks, email electronic, and other platforms virtual of sale of products and services, the payments are faster, and the products have catalogs and reviews for that others users decide whether to invest in your startup.

4 | Conclusion

This research established concepts, traits, and subtopics directly linked to the central focus of the study: technology in the entrepreneurial field. Technology is defined as a set of essential tools for creating something new or using something pre-existing to add differential value. It is notable that, as technology advances, the possibilities for the emergence of new businesses, entrepreneurs, and even entrepreneurs specialized in the technological field expand, thus boosting innovation and opportunities.

It is essential to highlight the role of ICTs in entrepreneurship, as they facilitate the viability and progress of a business, also giving it a competitive advantage. This is further enhanced by globalization, which fosters increased sales regardless of the company's scale, especially if it operates as a virtual store, opening avenues to the global market and generating key economic benefits for its sustainability. The study has contributed significantly by identifying and highlighting essential aspects that an entrepreneur can consider in a social context where new technological tools emerge every day. These, if properly managed, can be decisive in launching a successful product or business in the community.

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Author Contribution

All authors contributed equally to this work.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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