


THE ROLE OF TECHNOLOGICAL INNOVATION IN SUCCESS OF STARTUPS IN ALGERIA

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ARTICLE INFO	ABSTRACT
<p>Article history: Received: February, 13th 2024 Accepted: May, 03rd 2024</p>	<p>Objective: The objective of this study is to investigate the role of technological innovation in the success of startups in Algeria, with the aim of musing impact of Technological innovation has a positive impact on the survival of emerging enterprises by providing innovative products or services, which enhances their chances of survival in the market, and their innovative business models that help them compete and survive for a longer period in the market.</p>
<p>Keywords: Innovation; Technological Innovation; Startups; Entrepreneurship; Startup Ecosystem.</p> 	<p>Theoretical Framework: In this topic, the main concepts and theories that underpin the research are presented. Rupert Maclaurin developed Schumpeter's ideas and analysed technological innovation as a process and proposed the theory of technological innovation, which was later called the linear model of innovation, and Skawińska and Zalewski see that: Success of startups is about achieving a competitive advantage, which is embodied in the possession and application of intangible and unique resources and skills to meet the needs of the market faster and in a better way than competitors . stand out, providing a solid basis for understanding the context of the investigation.</p> <p>Method: The methodology adopted for this research comprises studying a sample of Algerian startups. Technological innovation in startups has been measured through three dimensions: product or service, process, and business. As for the impact on the success of startups, it has been measured through four dimensions: financing, revenues, employment, and survival. Data collection was carried out through by a questionnaire was presented in this study to a sample of startups in Algeria, and analysing the data based by the statistical program SPSS, V29 and partial least squares path modelling with Plspm package of the R program].</p> <p>Results and Discussion: The results obtained revealed that there is a positive impact of technological innovation on the success of startups and on both financing, revenues, employment, and survival. Besides, there are no statistically significant differences for personal and professional variables, except for gender, on the success of startups in Algeria. In the discussion section, these results are contextualized in light of the theoretical framework, highlighting the implications and relationships identified. Possible discrepancies and limitations of the study are also considered in this section. Research Implications: The practical and theoretical implications of this research are discussed, providing insights into how the results can be applied or influence practices in the field of Business management for startups. These implications could encompass small and medium enterprises in the North African region.</p>

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Originality/Value: This study contributes to the literature by accessing a new field of knowledge in Algeria, represented by emerging institutions, and the challenge of their continuity and success in competitive markets, as well as the use of new statistical methods. The relevance and value of this research are evidenced by confirmed results that the Technological innovation have a positive impact on financing Startups through innovative products and services provided by enterprises, which lead to increased investment and attract investor interest in emerging enterprises that have an innovative and scalable business model, improving opportunities for obtaining financing, as well as gaining new clients and users to create a new revenue streams through innovative products and services provided, and innovation in the process also contributes to reducing costs and increasing revenues.

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O PAPEL DA INOVAÇÃO TECNOLÓGICA NO SUCESSO DAS STARTUPS NA ARGÉLIA

RESUMO

Objetivo: O objetivo deste estudo é investigar o papel da inovação tecnológica no sucesso das startups na Argélia, com o intuito de investigar o impacto da inovação tecnológica na sobrevivência das empresas emergentes, fornecendo produtos ou serviços inovadores, o que aumenta suas chances de sobrevivência no mercado, e seus modelos de negócios inovadores que as ajudam a competir e sobreviver por um período mais longo no mercado.

Estrutura Teórica: Neste tópico, são apresentados os principais conceitos e teorias que sustentam a pesquisa. Rupert Maclaurin desenvolveu as ideias de Schumpeter e analisou a inovação tecnológica como um processo e propôs a teoria da inovação tecnológica, que mais tarde foi chamada de modelo linear de inovação, e Skawińska e Zalewski veem isso: O sucesso das startups tem a ver com a obtenção de uma vantagem competitiva, que se consubstancia na posse e aplicação de recursos e habilidades intangíveis e únicos para atender às necessidades do mercado mais rapidamente e de uma maneira melhor do que os concorrentes. se destacam, fornecendo uma base sólida para a compreensão do contexto da investigação.

Método: A metodologia adotada para esta pesquisa inclui o estudo de uma amostra de startups argelinas. A inovação tecnológica em start-ups foi medida por meio de três dimensões: produto ou serviço, processo e negócio. Quanto ao impacto no sucesso das start-ups, ele foi medido por meio de quatro dimensões: financiamento, receitas, emprego e sobrevivência. A coleta de dados foi realizada por meio de um questionário apresentado neste estudo a uma amostra de start-ups na Argélia, e a análise dos dados foi feita com base no programa estatístico SPSS, V29 e na modelagem de caminho de mínimos quadrados parciais com o pacote Plspm do programa R].

Resultados e Discussão: Os resultados obtidos revelaram que há um impacto positivo da inovação tecnológica sobre o sucesso das startups e sobre o financiamento, as receitas, o emprego e a sobrevivência. Além disso, não há diferenças estatisticamente significativas para as variáveis pessoais e profissionais, exceto para o gênero, no sucesso das startups na Argélia. Na seção de discussão, esses resultados são contextualizados à luz da estrutura teórica, destacando as implicações e os relacionamentos identificados. As possíveis discrepâncias e limitações do estudo também são consideradas nessa seção.

Implicações da Pesquisa: As implicações práticas e teóricas desta pesquisa são discutidas, fornecendo insights sobre como os resultados podem ser aplicados ou influenciar as práticas no campo da gestão de negócios para startups. Essas implicações podem abranger pequenas e médias empresas na região do norte da África.

Originalidade/Valor: Este estudo contribui para a literatura ao acessar um novo campo de conhecimento na Argélia, representado por instituições emergentes e o desafio de sua continuidade e sucesso em mercados competitivos, bem como o uso de novos métodos estatísticos. A relevância e o valor desta pesquisa são evidenciados pelos resultados confirmados de que a inovação tecnológica tem um impacto positivo no financiamento de startups por meio de produtos e serviços inovadores fornecidos pelas empresas, o que leva ao aumento do investimento e atrai o interesse dos investidores em empresas emergentes que têm um modelo de negócios inovador e escalável, melhorando as oportunidades de obtenção de financiamento, bem como conquistando novos clientes e usuários para criar novos fluxos de receita por meio de produtos e serviços inovadores fornecidos, e a inovação no processo também contribui para a redução de custos e o aumento das receitas.

Palavras-chave: Inovação, Inovação Tecnológica, Startups, Empreendedorismo, Ecosistema de Startups.

EL PAPEL DE LA INNOVACIÓN TECNOLÓGICA EN EL ÉXITO DE LAS STARTUPS EN ARGELIA

RESUMEN

Objetivo: El objetivo de este estudio es investigar el papel de la innovación tecnológica en el éxito de las startups en Argelia, con el fin de musing impact de La innovación tecnológica tiene un impacto positivo en la supervivencia de las empresas emergentes, proporcionando productos o servicios innovadores, lo que aumenta sus posibilidades de supervivencia en el mercado, y sus modelos de negocio innovadores que les ayudan a competir y sobrevivir por un período más largo en el mercado.

Marco Teórico: En este tema se presentan los principales conceptos y teorías que sustentan la investigación. Rupert Maclaurin desarrolló las ideas de Schumpeter y analizó la innovación tecnológica como un proceso y propuso la teoría de la innovación tecnológica, que más tarde se denominó modelo lineal de innovación, y Skawińska y Zalewski consideran que: El éxito de las startups consiste en lograr una ventaja competitiva, que se materializa en la posesión y aplicación de recursos y habilidades intangibles y únicos para satisfacer las necesidades del mercado más rápido y de mejor manera que los competidores. destacan, proporcionando una base sólida para comprender el contexto de la investigación.

Método: La metodología adoptada para esta investigación comprende el estudio de una muestra de startups argelinas. La innovación tecnológica en las startups se ha medido a través de tres dimensiones: producto o servicio, proceso y negocio. En cuanto al impacto en el éxito de las startups, se ha medido a través de cuatro dimensiones: financiación, ingresos, empleo y supervivencia. La recogida de datos se llevó a cabo a través de un cuestionario que se presentó en este estudio a una muestra de startups en Argelia, y el análisis de los datos se basó en el programa estadístico SPSS, V29 y el modelo de mínimos cuadrados parciales con el paquete Plspm del programa R].

Resultados y Discusión: Los resultados obtenidos revelan que existe un impacto positivo de la innovación tecnológica en el éxito de las startups y tanto en la financiación, como en los ingresos, el empleo y la supervivencia. Además, no existen diferencias estadísticamente significativas para las variables personales y profesionales, a excepción del género, sobre el éxito de las startups en Argelia. En la sección de discusión, estos resultados se contextualizan a la luz del marco teórico, destacando las implicaciones y relaciones identificadas. En esta sección también se consideran las posibles discrepancias y limitaciones del estudio.

Implicaciones de la Investigación: Se discuten las implicaciones prácticas y teóricas de esta investigación, proporcionando una visión de cómo los resultados pueden ser aplicados o influir en las prácticas en el campo de la gestión empresarial para startups. Estas implicaciones podrían abarcar a las pequeñas y medianas empresas de la región norteafricana.

Originalidad/Valor: Este estudio contribuye a la literatura al acceder a un nuevo campo de conocimiento en Argelia, representado por las instituciones emergentes, y el reto de su continuidad y éxito en mercados competitivos, así como el uso de nuevos métodos estadísticos. La relevancia y el valor de esta investigación se evidencian por los resultados confirmados de que la innovación tecnológica tiene un impacto positivo en la financiación de Starups a través de productos y servicios innovadores proporcionados por las empresas, que conducen a un aumento de la inversión y atraer el interés de los inversores en las empresas emergentes que tienen un modelo de negocio innovador y escalable, la mejora de las oportunidades de obtener financiación, así como la obtención de nuevos clientes y usuarios para crear un nuevo flujo de ingresos a través de productos y servicios innovadores proporcionados, y la innovación en el proceso también contribuye a reducir los costes y aumentar los ingresos.

Palabras clave: Innovación, Innovación Tecnológica, Startups, Emprendimiento, Ecosistema Startup.

1 INTRODUCTION

It is largely recognized that there is a correlation between entrepreneurship and innovation around the world, as innovation is a fundamental aspect of entrepreneurial behavior and a potential source of competitive advantage, which facilitates market entry and affects business performance and survival. Without innovation, new entrepreneurs and managers of existing institutions alike cannot distinguish themselves from competitors and risk the

opportunity to outperform them. What indicates that there is a positive overall relationship between innovation and entrepreneurial performance, is that a great number of innovations are developed by entrepreneurship, which confirms its important role in economic growth.

Startups are new and temporary; they have a business model based on innovation and technology. In addition, these types of institutions have the potential for rapid growth and scalability. Innovation plays a master role in these interesting institutions, as it refers to their ability as a living human system to flourish and learn from the continuous waves of change so that the latter is a natural and inevitable part of their lives and not a separate one or a threatening event.

Globally, startups have achieved an economic value of \$7.6 trillion for 2023 (Startup Genome, 2023). Although it is an exciting figure for startups, the latter suffer from high failure rates. According to experts, only 10% of them succeed while 90% fail in the market. Several studies claim that 50% of them fail in the first 5 years. This does not negate the overlap of several factors to achieve the required success, which led to a difference in the definition and evaluation of their success.

In the midst of these changes in the global economy, and similar to developing countries, Algeria awakened regarding these institutions since late 2019 and the beginning of 2020, where procedures and mechanisms that can help in the development and success of startups, as well as the Algerian ecosystem, that is a fertile system suitable for their success, have been carried out. This was the case for some of them, achieving a certain level of success and imposing themselves in the market.

In light of the above, and since startups are linked to innovation, there is an urgent need to identify the role of technological innovation in the success of these institutions in Algeria. Based on that, the problematic of this research is formulated in the following main question:

How does technological innovation contribute to the success of startups in Algeria?

1.1 RESEARCH HYPOTHESES

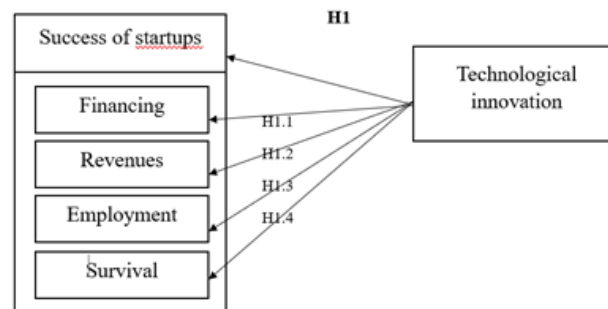
Main hypothesis: Technological innovation has a positive moral impact on the success of startups in Algeria.

- **first sub-hypothesis:** technological innovation has a positive impact in financing startups;
- **second sub-hypothesis:** Technological innovation has a positive impact on the revenues of startups;

- **third sub-hypothesis:** Technological innovation has a positive impact on employment in startups;
- **fourth sub-hypothesis:** Technological innovation has a positive impact on the survival of startups.

Figure 1

Conceptual framework of technological innovation affecting the success of startups



Source: Elaborated by the authors

2 TECHNOLOGICAL INNOVATION

Although most studies indicate that Schumpeter is the spiritual father of technological innovation and its leading role in introducing innovation into economic studies, according to a 1950 study (Benoît Godin, 2008), Rupert Maclaurin developed Schumpeter's ideas and analysed technological innovation as a process and proposed the theory of technological innovation, which was later called the linear model of innovation. He defined technological innovation as "the first marketing of a new or improved product or process."

According to the Innovation Act stated in Article 17 of the US Congress, "Technological innovation is considered as a concept of a new product or process by adding new functions or characteristics to the product or process that means gradual improvements and effective quality or increased productivity leading to competitiveness.

It is also defined as the introduction of new products and processes to enhance its competitive advantage and adapt to rapid technological changes in highly competitive global markets (Öztürk Danişman, 2022).

As a comprehensive definition, technological innovation is the set of overlapping processes that transform ideas and knowledge by providing new products, services or processes, business models or introducing improvements to existing products, services or processes, business models.

3 SUCCESS OF STARTUPS

The success and failure of startups are two sides of the same coin. If failure is the achievement of the unpopular, then success is the opposite. There are different definitions of success for startups (Santisteban et al. 2021).

According to Chang-Ryong Ko: The success of a startup is its successful entry into the market, achieving profits and securing sustainability. This is translated into achieving sales three years after its launch (Ko & An, 2019).

Skawińska and Zalewski see that: Success of startups is about achieving a competitive advantage, which is embodied in the possession and application of intangible and unique resources and skills to meet the needs of the market faster and in a better way than competitors.

Through the researchers' different definitions of the concept of success of startups, we find that:

- the first concept introduces the meaning of success according to financial standards as achieving high financial performance and revenues for the institution and obtaining funding;
- the second concept, which is related to survival and achieving sustainability in the market, is limited to three years, but there are those who limit it to 3-5 years to say that the startup is achieving success;
- the third concept is related to innovation and growth. It links the success of startups to innovation by providing products or services in addition to achieving growth as indicators of their success. Although it is difficult to measure success in this case, it is largely an objective perception because if it is achieved, then the two previous concepts are realized;
- as for the last concept, it linked the meaning of success of the startup to achieving the competitive advantage and meeting the needs of the market in addition to achieving the goals and objectives for which it was established.

4 STARTUP ECOSYSTEM IN ALGERIA

The term startup in Algeria is newly introduced. It has emerged during the last three years, and the State has recently sought to increase interest and support for this type of institutions, especially within the framework of its orientation towards diversifying the

economy and searching for alternatives other than hydrocarbons. The introduction of a new ministry in charge of startups and the knowledge economy was the starting point for developing the roadmap, the text of laws, executive decrees, providing support and encouraging the holders of ideas and projects, and providing a stimulating and supportive ecosystem for the creation of their institutions.

The first steps towards this were manifested in the government's announcement in March 2020 of the establishment of the Supreme Council for Innovation, which serves as the cornerstone of the strategic direction in the field of valuing innovative ideas and initiatives and the national potential of scientific research in the service of the development of the knowledge economy. Accordingly, it was decided to transform the hub of regional technological excellence, which was completed by Sonatrach, for the benefit of startups, in addition to enabling the holders of innovative projects and startups to benefit from the available spaces within the institutions of the youth and vocational training sectors at the national level, as well as preparing local communities for spaces dedicated to startups, with priority given to areas where there is great potential from the holders of innovative projects, especially the counties of Bechar, Ouargla, Constantine, Oran, Tlemcen, Setif and Batna before expanding this endeavour to the entire national territory.

Among the first steps initiated by the Algerian government as well, the issuance of Executive Decree No. 20-77 dated March 28th, 2020, amending and completing the Executive Decree No. 04-94 dated March 24th, 2004, bearing the establishment of the National Agency for the Promotion and Development of Technological Parks ANPT and determining its organization and functioning, according to which the latter was placed under the guardianship of the Ministry of Small-sized Enterprises, Startups and Knowledge Economy, in addition to amending the composition of the Agency's Board of Directors by appointing the Minister of Small-sized Enterprises, Startups and Knowledge Economy or his representative to head it, while expanding its formation to include a representative of the Minister of Post and Telecommunications and a representative of the Agency's workers (Algeria Press Service, 2020).

Moreover, on August 05th, 2020, an electronic platform related to startups was launched (www.startup.dz). The visitors may submit a request to be granted three labels: "startup", "innovative project", or "business incubator", attaching the documents specified in Executive Decree No. 20-254 dated September 15th, 2020, article 12 thereof. It is considered one of the most prominent initiatives adopted by the Algerian government in the field of startups, as stipulated in the same decree and decided to establish a national committee to grant the labels

of "startup", "innovative project" and "business incubator", with specific tasks, formation and progress. The decree assigns the committee to study and respond to applications within a maximum of thirty (30) days starting from the filing of the application, in article 13 thereof, and then grants the label of "startup" for a period of four (04) years renewable once, article 14. Adding to its aforementioned tasks, it contributes to the diagnosis and promotion of innovative projects and participating in the development of the startup ecosystem. The decree also specifies the conditions for granting the label of "startup" in six items as follows (Official Gazette, 2020):

- life of the startup must not exceed 8 years;
- business model of the startup should be based on products, services, business model or any innovative idea;
- annual turnover shall not exceed the amount determined by the national committee;
- share capital of the startup must be owned at least 50% by natural persons or approved investment funds or by other institutions bearing the startup label;
- growth potential of the startup should be large enough;
- number of workers should not exceed 250.

Despite the efforts exerted and the government's policy aimed at developing startups, the reality of the ecosystem is still late and has not reached the required level, such as the American or European systems or even the African and Arab ones. The latest report of the Startup Blink Foundation on the startup ecosystem classifications for the year 2023 showed the absence of Algeria from the classification, which included (100) countries. Algeria ranked 114 outside the classification by its progress from last year by 03 points ahead of the Dominican Republic (www.startupblink.com, 2023). Furthermore, the ranking of (1000) cities in the world showed the city of Algiers in the 546th place with a score of 0.423, ahead by +225 compared to 2022 (StartupBlink, 2023). Within the absence of a database of startups in Algeria, according to the Startup Ranking website, Algeria is generally in the middle of ranking globally and in Africa. It is somewhat ahead in the Arab ranking with an average of 100 startups based on the following table:

Table 1

Ranking of Arab and African countries in terms of the number of startups according to the Startup Ranking website for the year 2023.

Order	State	Number of startups
01	United Arab Emirates	1035
02	Nigeria	798
03	Egypt	628
04	South Africa	488
05	Kenya	331
06	Ghana	135
07	Kingdom of Saudi Arabia	122
08	Morocco	101
09	Algeria	100
10	Cameroon	98
11	Jordan	92
12	Ethiopia	64
13	Angola	62
14	Tunisia	56
15	Tanzania	50
16	Lebanon	47

Source: <https://www.startupranking.com/countries>

Number of startups in Algeria is still low compared to the United States, which leads the world with 75,892, and Africa, where the leadership occupies Nigeria and Egypt with 798 and 628 startups, respectively. As for the Arabs, the United Arab Emirates, Egypt, and Saudi Arabia with 1035, 628, and 122 startups are superior. The low number of startups in Algeria is due to their lack of an appropriate ecosystem and the lack of diversity and density in it. This confirms that the interest in startups in Algeria began recently in the post-2020 period, which the government has set among its priorities and strategies for diversity in the national economy, requiring the exertion of more on efforts to build and develop the appropriate ecosystem for this type of institutions and supporting them.

5 RESEARCH METHODOLOGY

The sample of the study was a random sample of 52 successful startups on the Algerian national territory, where 139 electronic questionnaires using (Microsoft Form) in Arabic and English versions were distributed to the founders and team members of the startups, through LinkedIn and other social networking sites such as Instagram, Facebook, in addition to their emails. 52 questionnaires were retrieved, all of which are analysable.

In order to reach the desired results and after the final collection of the questionnaires, the data were processed using analytical and statistical tools, so the methods of analysis in this study were limited to the following programs: Excel 2019, SPSS.V29, R4.3.2 (Plspm).

6 RESULTS AND DISCUSSION

6.1 ANALYSIS OF CROSS-LOAD COEFFICIENTS OF THE STUDY SAMPLE

Cross-load coefficients can also be analysed with external load coefficients for each of the latent variables as shown in the following table:

Table 2

Latent variables

Items	Technological innovation	Success of startups	Financing	Revenues	Employment	Survival
prse6	0.826	0.692	0.602	0.681	0.519	0.576
pro9	0.725	0.558	0.538	0.571	0.463	0.362
pro12	0.778	0.588	0.528	0.543	0.560	0.389
bm13	0.910	0.813	0.718	0.716	0.738	0.623
bm16	0.871	0.709	0.625	0.670	0.597	0.545
bm17	0.771	0.615	0.485	0.522	0.532	0.556
bm18	0.801	0.723	0.633	0.591	0.661	0.601
bm21	0.773	0.689	0.612	0.728	0.489	0.541
fin23	0.640	0.758	0.903	0.706	0.615	0.473
fin24	0.636	0.708	0.877	0.712	0.579	0.363
fin25	0.631	0.732	0.803	0.641	0.624	0.513
rev27	0.806	0.816	0.704	0.900	0.608	0.584
rev28	0.658	0.744	0.608	0.890	0.478	0.559
rev29	0.582	0.716	0.693	0.883	0.449	0.455
rev30	0.666	0.730	0.762	0.849	0.507	0.434
rev31	0.602	0.698	0.661	0.769	0.485	0.501
emp32	0.766	0.858	0.745	0.631	0.910	0.659
emp33	0.509	0.713	0.532	0.480	0.858	0.542
emp34	0.625	0.802	0.617	0.516	0.929	0.662
emp35	0.616	0.761	0.601	0.503	0.898	0.587
emp36	0.633	0.775	0.626	0.511	0.894	0.610
Sur37	0.603	0.781	0.473	0.564	0.634	0.944
Sur38	0.674	0.789	0.515	0.578	0.651	0.910
Sur39	0.496	0.719	0.422	0.520	0.557	0.904
sur40	0.552	0.746	0.444	0.508	0.626	0.917
sur41	0.624	0.747	0.500	0.517	0.632	0.869

Source: R 4.3.2 Plspm package usage output

The table above shows, by comparing the cross-load coefficients with the external load coefficients for each latent variable, that is, the external load coefficients of the technological

innovation variable recorded higher values than the cross-load coefficients corresponding to the other structures. They are the external load coefficients for each of the success of startups, financing, revenues, employment, and survival, after comparing each item of the technological innovation variable with the items of the remaining latent ones.

It is noted in the table as well, by comparing the cross-load coefficients with the external load coefficients of each latent variable, that the external load coefficients of the success of startups variable recorded higher values than the cross-load coefficients corresponding to other structures. They are the load coefficients of technological innovation, after comparing each item of the financing variable with the items of the remaining latent ones.

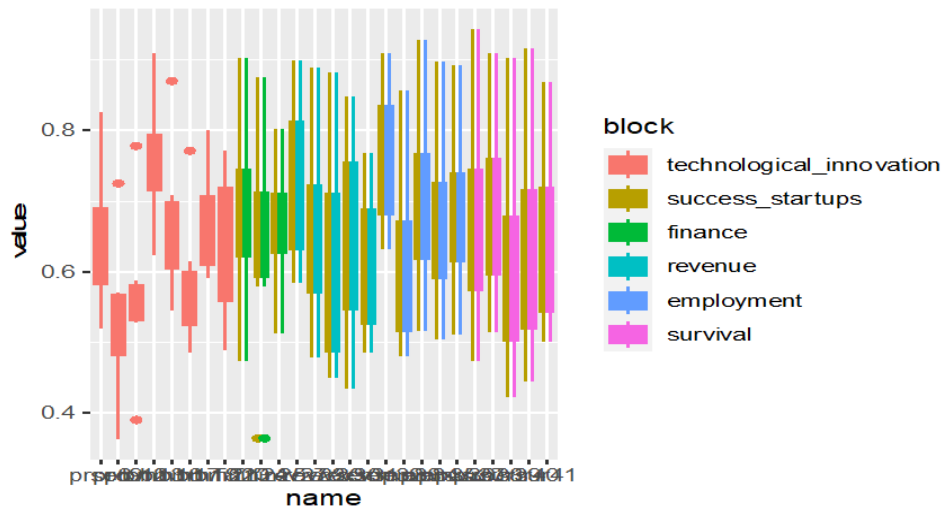
It is also noted from the table, by comparing the cross-load coefficients with the external load coefficients for each latent variable, that the external load coefficients for the financing variable have higher values than the cross-load coefficients corresponding to other construct. They are the load coefficients of technological innovation, after comparing each item of the financing variable with the items of the remaining latent ones.

In the said table, and by comparing the cross-load coefficients with the external load coefficients for each latent variable, the external load coefficients for the revenues' variable recorded higher values than the cross-load coefficients corresponding to other structures. They are the load coefficients of technological innovation, after comparing each item of the revenues' variable with the items of the remaining latent ones.

As for the employment variable, it is noticeable that after comparing the cross-load coefficients with the external load coefficients of each latent variable, the external load coefficients of the employment variable recorded higher values than the cross-load coefficients corresponding to the other structures. They are the load coefficients of technological innovation, after comparing each item of the employment variable with the items of the remaining latent ones.

It is also noted in the previous table, by comparing the cross-load coefficients with the external load coefficients for each latent variable, that the external load coefficients for the survival variable recorded higher values than the cross-load coefficients corresponding to other structures. They are the load coefficients of technological innovation after comparing each item of the survival variable with the items of the remaining latent ones.

The following diagram shows well the cross-load coefficients:

Figure 2*Cross-load coefficients*

Source: R 4.3.2 Plspm package usage output

The figure above shows the cross-load coefficients. The red colour represents the variable of technological innovation, the brown colour is the variable of success of startups, the green represents the variable of funding, the light blue is the variable of revenue, the blue represents the variable of employment, while the purple represents the variable of survival.

Only the red appears in the first part of the figure, which is the cross of the items of the technological innovation variable with the other latent variables, that is, the external load coefficients of the technological innovation variable were higher than the cross-load coefficients of the remaining variables.

Only the brown appears in the second part of the figure, which is the cross of the items of the success of startups variable with the other latent ones, that is, the external load coefficients of the success of startups variable were higher than the cross-load coefficients of the remaining variable.

In the third part of the figure, only the green colour appears, which is the cross of the items of the financing variable with the other latent ones, that is, the external load coefficients of the financing variable were higher than the cross-load coefficients of the remaining variables.

The light blue colour appears in the fourth part of the figure, which is the cross of the items of the revenue variable with the other latent ones, that is, the external load coefficients of the revenue variable were higher than the cross-load coefficients of the remaining variables.

Only the blue appears in the fifth part of the figure, which is the cross of the items of the employment variable with the other latent ones, that is, the external load coefficients of the employment variable were higher than the cross-load coefficients of the remaining variables.

Finally the purple appears in the sixth part of the figure, which is the cross of the items of the survival variable with the other latent ones, that is, the external load coefficients of the survival variable were higher than the cross-load coefficients of the remaining variables. Therefore, it is possible to adopt the scale of the variables included in the study, shown in the following figure:

Figure 3

Load coefficients measured parameters of latent variables included in the model



Source: Elaborated by the author using R 4.3.2 Plspm package

The figure above shows the load changes or saturations related to the study variables. It is noted that:

- technological innovation latent variable:** the technological innovation variable recorded saturation with eight items, all of which were greater than 0.7, namely: prse6 "Focus on the needs of customers and target users when developing a product or service" with a value of (0.826). The item pro9 "The process changes quickly in your startup according to new technology" with a value of (0.725). The item pro12 "Your startup seeks to reduce costs in the process" with a value of (0.7782). The item bm13 "Your startup undertakes new processes and structures" with a value record of (0.9097). The item bm16 "Your startup resorts to search for new customers and users" with a value of (0.8705). The item bm17 "Your startup is looking for new distribution channels" with a value of (0.7715). The item bm18 "Your startup aims to enter into new market sectors"

with a value of (0.801), and the item bm21 "Your startup focuses on flexibility of the business model to keep pace with the development of the market" with a value of (0.7726);

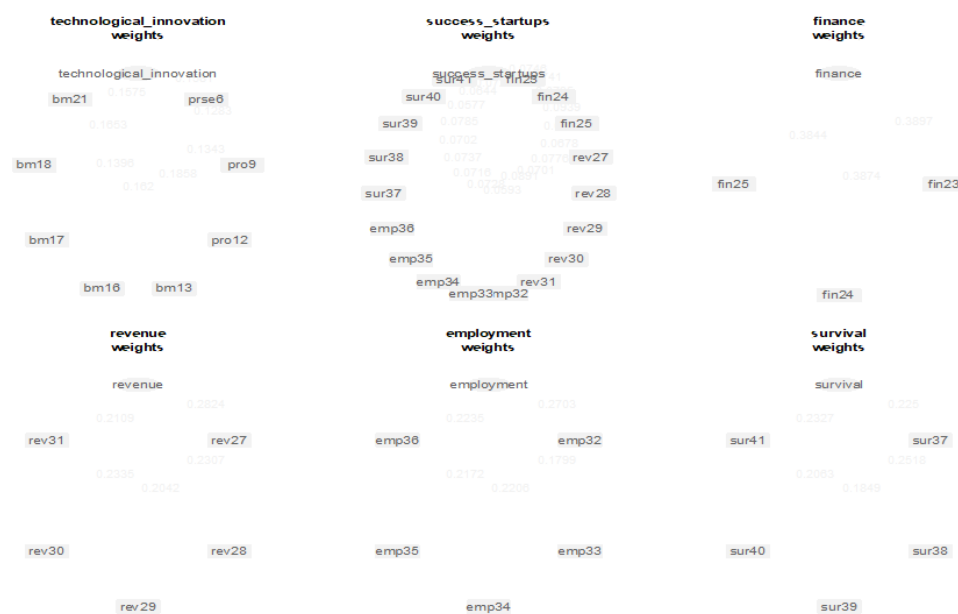
- **financing latent variable:** we note that the latent variable represented in financing has been saturated with three items, namely: fin23 "Innovative products and services lead to increased investment in your startup" with a value of (0.903). The item fin24 "Innovation in the process improves the chance of your startup to obtain financing" with a value of (0.8765), and the item fin25 "Investors are interested in the startup that has an innovative and scalable business model" with a value of (0.8025);
- **revenues latent variable:** it is also noted that the latent variable of revenues recorded saturation with five items, namely: rev27 "Your startup is looking for new ways to gain more customers and users" with a value of (0.8999). The item rev28 "Innovative products or services in your startup lead to the creation of new revenue streams" with a value of (0.8902). The item rev29 "Innovation in the process contributes to reducing cost and this leads to higher revenues" with a value of (0.8826). As for the item rev30 "The innovative business model of the startup contributes to obtaining new sources of revenue" reaches the value (0.8485), and the item rev31 "Volume of sales and net profits in your startup increases" with a value of (0.7691);
- **employment latent variable:** the figure shows that the latent variable of employment is saturated with five items, namely: emp32 "Searching for diverse experiences and specializations in work team employees" with a value of (0.9099). The item emp33 "Your startup focuses on the marketing skills of work team employees" with a value of (0.8576). The item emp34 "Your startup seeks to attract and retain outstanding employees" with a value of (0.9294). The item emp35 "Your startup works to increase job creation when entering new markets" with a value of (0.8981). The item emp36 "Your startup is interested in a culture of innovation that enables the work team to generate new ideas and solutions" with a value of (0.8937);
- **survival latent variable:** it is noted in the above figure that the latent variable of survival recorded saturation with five items, namely: sur37 "Your startup considers the high survival rate as a positive indicator" with a value of (0.9438). The sur38 "Your startup plans ahead to stay in the market for a longer period" with a value of (0.9096). The item sur39 "Providing innovative products or services that enhance the chances of survival of your startup" with a value of (0.9038). The item sur40 "Your startup relies on innovation in the process in response to market changes and to increase its chances of survival" with

a value of (0.9172). The item 41 "The innovative business model helps your startup to compete and survive in the market in the long term" with a value of (0.869);

Success of startups latent variable: As for the latent variable of the success of startups, from the above figure, it is clear that it recorded saturation with eighteen items, which included each of the items of funding, revenues, employment, survival, that we mentioned earlier.

Figure 4

Weights of measured variables of latent variables included in the model



Source: R 4.3.2 Plspm package usage output

The above figure shows that all the measured variables of the latent variables included in the model had positive weights. This is a good indicator that they are of valid and are measured from one dimension. The figure shows that the latent variable of technological innovation had all positive weights, which are as follows: prse6 "Focus on the needs of customers and target users when developing a product or service" with a weight of (0.1581). The item pro9 "The process changes quickly in your startup according to the new technology" with a weight of (0.1283). The item pro12 "Your startup seeks to reduce the costs in the process" estimated at a weight of (0.1343). The item bm13 "Your startup is conducting new operations and structures" with a weight of (0.1858). The item bm16 "Your startup is seeking new customers and users" with a weight of (0.162). The item bm17 "Your startup is looking for new distribution channels" with a weight of (0.1396). The item bm18 "Your startup aims to enter into new market sectors" with a weight of (0.1653), and the item bm21 "Your startup focuses on the flexibility of the model work to keep pace with the development of the market" with a

weight of (0.1575). Therefore, all the weights of the measured variables of the technological innovation latent variable in the model were positive, proving its validity and this is a good indicator that it measures one dimension.

It is noted as well that all the weights of the financing latent variable are positive, which are as follows: fin23 "Innovative products and services lead to an increase in investment in your startup" with a weight of (0.3897). The item fin24 "Innovation in the process improves the chance of your startup to obtain financing" with a weight of (0.3874), and the item fin25 "Investors are interested in the startup that has an innovative and scalable business model" with a weight of (0.3844). Therefore, all the weights of the measured variables of the financing latent variable in the model were positive, proving its validity and this is a good indicator that it measures one dimension.

Revenues latent variable has also positive weights as follows: rev27 "Your startup is looking for new ways to gain more customers and users" with a weight of (0.2824). The item rev28 "Innovative products or services in your startup create new revenue streams" with a weight of (0.2307). The item rev29 "Innovation in the process contributes to reducing the cost and this leads to higher revenues" with a weight of (0.2042). The item rev30 "The innovative business model of the startup contributes to obtaining new sources of revenues", with a weight of (0.2335), and the item rev31 "Volume of sales and net profits in your startup increases" with a weight of (0.2109), so all the weights of the measured variables of the revenues latent variable in the model were positive, proving their validity and this is a good indicator that it measures one dimension.

Concerning the employment latent variable, all its weights were positive, as follows: emp32 " Searching for diverse experiences and specializations in the staff of the work team" with a weight of (0.2703). The item emp33 "Your startup focuses on the marketing skills of the staff of the work team" with a weight of (0.1799). The item emp34 "Your startup seeks to attract and retain outstanding employees" with a weight of (0.2206). The item emp35 "Your startup works to increase job creation when entering new markets" with a weight of (0.2172), and the item emp36 "Your startup is interested in the culture of innovation that enables the work team to generate new ideas and solutions" with a weight of (0.2235). Thus, all the weights of the measured variables for the employment latent variable in the model were positive, proving its high validity and this is a good indicator that it measures one dimension.

The figure also shows that the survival latent variable had positive weights as follows: sur37 "Your startup considers the high survival rate as a positive indicator" with a weight of

(0.225). The item sur38 "Your startup plans to survive in the market for a longer period of time" with a weight of (0.2518). The item sur39 "Providing innovative products or services that enhance the chances of survival of your startup" with a weight of (0.1849). The item sur40 "Your startup relies on innovation in the process in response to market changes and to increase its chances of survival" with a weight of (0.2063), and the item sur41 "Your startup's innovative business model helps your startup compete and survive in the market in the long term" with a weight of (0.2327), so all the measured weights of the survival variable in the model were positive, proving its validity and this is a good indicator that it measures one dimension.

6.2 STRUCTURAL MODEL OF THE STUDY

The suggested study model is to identify five effects (05) among the variables related to the study. They relate to the impact of the independent variable "technological innovation" on the dependent variable "success of startups", in addition to its four effects on the dimensions of the dependent variable, that is, through "financing", "revenues", "employment", and "survival". The structural model of the study is as follows:

Figure 5

Direct impact on the structural model of the study



Source: R 4.3.2 Plspm package usage output

The above figure shows that there is a direct impact of the study variables, and all of them are positive. The direct impact of the independent variable "technological innovation" was recorded on the dependent variable "success of startups", with a value of (0.8397). The direct impact of independent variable "technological innovation" was recorded on the dimension of "revenues" as the greatest one, with a value of (0.7805). Followed by the direct impact of the

independent variable "technological innovation" recorded on the dimension of "financing" with a value of (0.7385). The direct impact of the independent variable "technological innovation" was recorded on the dimension of "employment" with a value of (0.711). In the fourth place and as the least one, the direct impact of the independent variable "technological innovation" was recorded on the dimension of "survival" with a value of (0.6558).

The quality of the model reached (0.6134), which is greater than 0.5, so the model is of good quality. The structural model can be evaluated through the coefficient of determination at the internal variables shown in the following table:

Table 3

Determination coefficients in the structural model

Variable	Type of variable	Determination coefficient (R ²)
Technological innovation	External	
Success of startups	Internal	0.705
Financing	Internal	0.545
Revenues	Internal	0.609
Employment	Internal	0.506
Survival	Internal	0.430

Source: R 4.3.2 Plspm package usage output

The values of the determination coefficient R² greater than 0.60 are high values and the values between 0.30 and 0.60 are moderate ones. As for the values less than 0.30, they are low (Sarstedt et al., 2020). The above table shows that the determination coefficient at the internal variable "success of startups", which is the dependent variable, is estimated at a value higher than 0.7. It scored (0.705), which is a high value, explaining a good percentage of the impact of technological innovation on the success of startups, which is characterized by harmonious dimensions. As for the determination coefficient at the internal variable of "revenue" dimension, it is estimated at a value of (0.609). It is a high value, meaning that technological innovation has an impact on the revenues of startups. The values of "financing" and "employment" are respectively (0.545), (0.506). They are moderate values for the impact of technological innovation in financing and employment in startups. As for the determination coefficient at the internal variable of "survival" dimension, it is estimated at a value of (0.430). It is a moderate value, meaning that the impact of technological innovation explains an average percentage in the survival of startups.

6.3 HYPOTHESIS TESTING

This study is based on testing five hypotheses, identifying five effects among the variables related to the study, and studying the impact between them.

6.3.1 Main hypothesis testing

The first hypothesis states that: H1 "Technological innovation has a positive moral impact on the success of startups in Algeria." To test this hypothesis, the student test is used, the results of which are shown in the following table:

Table 4

Main hypothesis testing

	Impact	Standard Deviation	t-statistics	P-value	Results
Technological Innovation-> Startup Success	0.840	0.07	1.09	0.00	Moral

Source: R 4.3.2 Plspm package usage output

The above table shows that the direct impact of the independent variable "technological innovation" on the dependent variable "success of startups" was positive with a value of 0.840. The value of (student) was 1.09, and the probabilistic value was less than 0.05. Thus, the impact was positive moral. This confirms the validity of the first main hypothesis "Technological innovation has a positive moral impact on the success of startups in Algeria." This result can be explained by the fact that the ability of startups in Algeria to innovate technologically through the product or service, the process, and the business model enhances their success. This is consistent with previous studies; (Guo et al., 2019), and this is also confirmed by a study (Nouri Mohamed El-Amin, 2023) entitled "Analytical Study of the Factors of Success and Failure of Startups in Algeria and their Development Strategies."

6.3.2 First sub-hypothesis testing

The first sub-hypothesis states that: H1.1 "Technological innovation (product/service, process, business model) has a positive moral impact in financing startups." To test this hypothesis, the student test is used, the results of which are shown in the following table:

Table 5*First sub-hypothesis testing*

	Impact	Standard Deviation	t-statistics	P-value	Results
Technological Innovation-> Financing	0.739	0.09	7.75	0.00	Moral

Source: R 4.3.2 Plspm package usage output

The above table shows that the direct impact of the independent variable of technological innovation on the financing dimension was positive with a value of 0.739, and the value of t (student) was 7.75. The probabilistic value was less than 0.05, of which the impact was positive moral. This confirms the validity of the first sub-hypothesis of "technological innovation (product/service, process, business model) has a positive moral impact in financing startups ". This can be explained by the fact that innovative products and services lead to increased investment and attract investors' interest in startups that have an innovative and scalable business model to improve access to financing. These results are consistent with previous studies (Bocken, 2015); (Kee et al., 2019), and differed with another study (Abdulla et al., 2021), that failed to confirm the positive impact of technological innovation in financing startups.

6.3.3 Second sub-hypothesis testing

The second sub-hypothesis states that: H2.1 "Technological innovation (product/service, process, business model) has a positive moral impact on the revenues of startups." To test this hypothesis, the student test is used, the results of which are shown in the following table:

Table 6*Second sub-hypothesis testing*

	Impact	Standard Deviation	t-statistics	P-value	Results
Technological Innovation-> Revenues	0.781	0.08	8.83	0.00	Moral

Source: R 4.3.2 Plspm package usage output

The above table shows that the direct impact of the independent variable of technological innovation on the revenues dimension was positive with a value of 0.781, the value of t(student) was 8.83 and the probabilistic value was less than 0.05, of which the impact

was positive moral. This confirms the validity of the second sub-hypothesis of "technological innovation (product/service, process, business model) has a positive moral impact on the revenues of startups." In this regard, these results can be explained by the fact that startups in Algeria are looking for new ways to gain new customers and users, which enhances the creation of new revenues streams through the provided innovative products or services. Innovation in the process also contributes to reducing costs and increasing revenues. These results are consistent with previous studies (Securato, 2021).

6.3.4 Third sub-hypothesis testing

The third sub-hypothesis states that: H3.1 "Technological innovation (product/service, process, business model) has a positive moral impact on employment in startups ", and to test this hypothesis, the student test is used, the results of which are shown in the following table:

Table 7

Third sub-hypothesis testing

	Impact	Standard Deviation	t-statistics	P-value	Results
Technological Innovation-> Employment	0.711	0.09	7.15	0.00	Moral

Source: R 4.3.2 Plspm package usage output

The above table shows that the direct impact of the independent variable technological innovation on the employment dimension was positive with a value of 0.711, the value of t(student) was 7.15, the probabilistic value was less than 0.05, and the impact was positive moral. This confirms the validity of the third sub-hypothesis " Technological innovation (product/service, process, business model) has a positive moral impact on employment in startups ". These results can be explained by the fact that startups in Algeria seek to search for diverse experiences and disciplines in the staff of their teams and their interest in the innovative culture that enables them to generate new ideas and solutions. These results are consistent with previous studies (Skawińska & Zalewski, 2020); (Nadji Mohammed, 2023).

6.3.5 Fourth sub-hypothesis testing

The fourth sub-hypothesis states that: H4.1 "Technological innovation (product/service, process, business model) has a positive moral impact on the survival of startups." To test this hypothesis, the student test is used, the results of which are shown in the following table:

Table 8

Fourth sub-hypothesis testing

	Impact	Standard Deviation	t-statistics	P-value	Result
Technological Innovation-> Survival	0.656	0.10	6.14	0.00	Moral

Source: R 4.3.2 Plspm package usage output

The above table shows that the direct impact of the independent variable technological innovation on the survival dimension was positive, with a value of 0.656, the value of t student was 6.14, the probabilistic value was less 0.05, and the impact was positive moral. This confirms the validity of the third sub-hypothesis "Technological innovation (product/service, process, business model) has a positive moral impact on the survival of startups ". These results are explained by the fact that startups in Algeria consider survival as a positive indicator by providing innovative products or services, which enhances their chances of survival in the market, and their innovative business models that help them compete and survive for a longer period in the market. These results are consistent with previous studies (Fitria & Hakim, 2022).

7 CONCLUSION

This study aimed to explore the role of technological innovation in the success of startups in Algeria. To achieve this goal, the theoretical literature that shed light on both technological innovation and the success of startups based on their conceptual framework to analyse their reality in Algeria were presented. It showed that they still need to be pushed to achieve the required success. Based on that, the two researchers developed a model for the study, through which they sought to explore and analyse the role of technological innovation. Starting from previous studies, the success of startups was evaluated through the four dimensions of financing, revenues, employment and survival. The main findings of the study are as follows:

- there is multiplicity and diversity in the success factors of startups, and this is due in large part to the nature of the ecosystems and their differences in which these institutions operate from one country to another;
- Algeria's interest in startups began in late 2019 and the beginning of 2020, where mechanisms and procedures were developed, starting with the establishment of a ministry dedicated to startups and the knowledge economy, in addition to the development of legal frameworks to regulate this type of institutions. However, this is not enough and the ecosystem of startups in Algeria is still late compared to the leading countries in this field, as confirmed by the results of reports on this subject;
- the results showed that technological innovation has a positive impact on the success of startups in Algeria, through their ability to innovate technologically using the product or service, process, and business model, which enhances their success;
- the results showed as well that technological innovation has a positive impact in financing startups through innovative products and services provided by institutions that lead to increased investment and attract investors' interest in startups that have an innovative and scalable business model to improve access to financing;
- also, technological innovation has a positive impact on the revenues of startups in terms of gaining new customers and users to create new revenue streams through the provided innovative products and services. Innovation contributes as well to the process by reducing costs and increasing revenues;
- technological innovation has a positive impact on employment in startups by seeking diverse expertise and specializations in the staff of their teams and their interest in the innovative culture that enables them to generate new ideas and solutions;
- the results proved that technological innovation has a positive impact on the survival of startups by providing innovative products or services that enhance their chances of survival in the market, and innovative business models that help them compete and survive longer in the market.

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