

## Article

# The Relationship between Digital Technology and the Development of the Entrepreneurial Competencies of Young People in the Medical Field

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**Abstract:** Digital technology is an important tool that influences employees from the healthcare sector to manifest their intention to become an entrepreneur. Furthermore, the last pandemic crisis underlined the importance of digitalizing the relationship between medical staff and patients. The research aims to evaluate how digital technology influences the development of the entrepreneurial spirit of young people working in the medical field. The data were gathered from a sample of 395 young people with medical studies and analyzed with SMARTPLS4 using the PLS-SEM method. The motivation of young people with a background in the medical field to become entrepreneurs is strongly influenced by the objective assessment of the level of digitalization of the medical field. The usability and availability of new technology give people with a background in the medical field the desire to become an entrepreneur in this domain. The young people perceive their entrepreneurial potential in complementarity with the level of digitalization of the medical field. The research's theoretical and practical contributions are underlined by the features of the young people that consider new technology as an omnipresent tool in their life. In the medical field, there are few theoretical papers and studies on the entrepreneurial spirit of young people with a background in healthcare, and our research underlines the importance of training the entrepreneurial competencies of young people in the medical field. The COVID-19 pandemic underlined the relevance of entrepreneurial competencies in building sustainable healthcare practices and identifying the deficiencies of healthcare systems to find timely solutions for the benefit of the patients. Therefore, the challenges related to the medical services market require a new approach to doctors' entrepreneurial competencies.

**Keywords:** digital technology; entrepreneurship; medical field

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## 1. Introduction

The pandemic generated by COVID-19 intensified the digitization process of the medical system. The concept of medical entrepreneurship is strongly related to the business environment, and people see the medical entrepreneur as a person with business competencies rather than a person with a background in the medical field or a degree in medicine, pharmacy, kinesiotherapy, or other medical fields. Therefore, we evaluated if the people working or studying in the medical field consider developing their knowledge and competencies in entrepreneurship challenging [1,2].

The development of entrepreneurial skills in the medical field is a necessity generated by both the development of new technologies and the implementation of Artificial Intelligence, as well as by the opportunity that medical specialists have to provide quality services in real time and with fewer medical errors.

The research's main objective is to evaluate how digital technology influences the development of the entrepreneurial spirit of young people working in the medical field.

Young people who are students or recent medical school graduates are familiar with digital technology, being digital natives. That is why one of our secondary research objectives is to evaluate how young people adapt this technology to the specifics of medical activity.

One of the main motivations of young people with a background in the medical field to develop their entrepreneurial competencies in connection with promoting new technology consists of placing value on the unexploited potential of digital tools to reduce inequalities among patients and to increase patients' healthcare access across all categories. Mohamad Jawad et al. [3] analyzed 106 papers and observed that researchers have paid huge attention to the impact of new technology on patients' and medical employees' lives. Therefore, to increase the potential of the new technology, it must be smartly and efficiently used.

Zubaydi et al. [4] (p. 24) concluded that the problems of the healthcare system are generated by a "lack of patient-centric approaches, inability to connect disparate systems, poor interoperability between systems, and Electronic Healthcare Record (EHR) accuracy". Ali et al. [5] proposed a patient healthcare framework that could give patients and medical employees feelings of security and reliability when they use digital tools. Nichifor et al. [6] underlined the importance of entrepreneurs to self-assess their digital knowledge level in developing entrepreneurial and digital competencies.

Therefore, starting from the meaning of digital health entrepreneurs, defined by Wulfovich and Meyers [7] (p.V) as "those who pursue opportunity under conditions of uncertainty with the goal of creating healthcare stakeholder value through the deployment of digital health innovation, are at the forefront of creating these new platforms and models", we go further and develop this definition by adding the individual feature reflected in the motivation and satisfaction of people to become entrepreneurs in the medical field.

Mitchelmore and Rowley [8] (p.93) presented motivation and satisfaction as an integral part of a "specific group of competencies relevant to the exercise of successful entrepreneurship". Therefore, it is a dilemma in the medical domain related to which relevant competencies are from the medical, digital, or business domains.

Analyzing the different approaches to this subject, we consider that this dilemma represents an answer to another dilemma related to the potential of robots to replace human beings in medical acts.

Sustainable development in the medical field is an approach based on the ability of people (medical employees and patients) to integrate digital tools in activities aimed at improving the medical act. The quality of the medical act depends on the abilities of the medical staff to cause the patient to trust the digital technology and to become an active actor in the realization of this medical act.

Starting from the already consecrated statement that sustainability is based on three pillars (i.e., economic, social, and environmental), sustainability in the medical field has the particularity that the social field represents priority and the sustainable development of this field involves all stakeholders, because without another triple bottom line medical employees-digital technology-patients, the quality of the medical acts will be unsuccessful. The advantage of using digital technology in the sustainable development of the medical field consists of the possibility of translating medical outcomes from a local scale to a global one.

In our research, we started with the premise of the health system's sustainability, which the employees must ensure in this field. Therefore, we developed the following research questions:

- How will the new medical technologies and the digitalization of the healthcare system contribute to developing the entrepreneurial competencies of medical employees?
- What is the level of awareness among young people of the importance of entrepreneurial skills in promoting the sustainable development of the medical field?
- What entrepreneurial skills are needed for a medical student and/or graduate to ensure the sustainability of the healthcare system?
- Is it appropriate to introduce elements of entrepreneurship and digitalization in the medical curriculum?

The paper has a logical structure, starting with a literature review section, followed by the methodology, the results, and discussion sections.

## 2. Literature Review

Technology is ubiquitous and takes countless forms as it is well anchored in the health-care sector. A review of the specialized literature demonstrates that, currently, there are few medical specialties untouched by the interference of technology [9,10]. The COVID-19 crisis underlined the potential of digital technologies in improving the medical act and caused a regression of traditional approaches in favor of those who use digital technology.

Practitioners in the medical field consider a relevant change in the balance of power under the impact of digitalization that transforms medical services in terms of accessibility and availability for interested people [11–14]. In medical practice, the following technology applications are noted: big data, artificial intelligence, genomics, analytics, telemedicine, smart and wearable devices, and mobile health applications. For example, a day of hospitalization in the digital age means interaction with chatbot systems based on artificial intelligence [15], electronic health records [16], wearable devices [17], and postoperative follow-up by telemedicine [18].

Vial [19] (p. 118) defined digital transformation as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies”. Therefore, the implementation of digitalization is approached as a qualitative leap supported by substantial changes in the content of an entity’s internal and relational elements.

All stakeholders should be involved in the digital transformation process since the first stage of this process, and also communication, should be continuously improved to ensure patient care together with the development of new technology [10]. The role of the medical entrepreneur in digital transformation is established by first considering the degree of usability and the flexibility of using the new technology and, secondly, the degree of its physical and financial accessibility.

Usability is seen as a defining concept for the efficiency and safe use of products and equipment during the treatment of patients. The satisfaction of patients and medical staff is directly affected by the ease with which a product or equipment can be used to achieve its purpose. The easier it is to use a product, including technology, the more often it will be used. The medical market only accepts products with good and measurable use. When performing tests regarding a medical product’s usability, three dimensions are tested: effectiveness, efficiency, and satisfaction.

The number and nature of the limitations or constraints regarding the use of any digitized medical device attract success or, on the contrary, failure, regarding its use by beneficiaries (patients, medical personnel, and other interested persons).

The design and development of medical equipment technologies must consider the skills that doctors can acquire in terms of digital literacy. Within the framework of the extent of the development of the medical technology industry, usability has even become a selection criterion for the equipment used in the exercises of the medical profession. More precisely, the issue regarding the utility of health information technology has been, for a decade, a safety and efficiency benchmark that interests doctors, patients, or users in general when they decide to use medical equipment that includes new technologies [20]. For years, the issue of access to medical technology—a right derived from the right to health—has been raised on the global medical scene.

The first characteristic of any new technology that aspires to improve the quality of life and health is, first of all, to be available to be used by doctors and patients. Therefore, the availability of medical technology was approached in close connection with the costs and the economic impact on the medical act [21–24].

The symbiosis between medical and entrepreneurial skills generates new solutions that represent an opportunity for medical personnel and the medical sector to improve patient health outcomes with lower costs and increasingly reduced waiting time.

Numerous studies have concluded that medical technology access and diffusion, mainly as a benefit of economic power, lead to inequity [25–27]. Technologies initially developed in other industries have successfully adapted to the medical sector. An instructive example is using smartphones and the Internet, which has allowed digital health technology to become the control center of healthcare delivery [28–30]. Availability is one of the main attributes of digital medical technology—many medical applications can be used anywhere, anytime, by anyone [31]. In the medical field, the performing economies generate technological products and applications that include extensive financial, logistical, and informational resources. Therefore, many problems related to implementing health solutions remain topical [32].

The costs related to the discovery and development of these products limit the beneficiaries' access concerning their creditworthiness. A substantial contribution that entrepreneurial activities make to provide opportunities for health and a better life for individuals all over the world is innovation. In this context, a new concept arises—innovative medical entrepreneurship.

Toner and Tompkins [33] argued that innovation could be the answer to solving the problems faced by the health system. On the other hand, Bärnreuther [34] presented the risks, fears, and weaknesses of social entrepreneurship and the application of innovation in a specific health system in an extensive case study. Like any other entity engaged in economic activity, medical entrepreneurs must consider the changes in the external environment.

The impact of COVID-19 on all actors in the medical field was so powerful that the academic community has been debating a new topic: the transition from reimagining to recreating the Health Care sector [35–38]. Thus, it is necessary to recreate the medical telemedicine system, engage Artificial intelligence (AI) in surgery, medical decision-making, or diagnostics, and reshape the healthcare landscape [39].

Digital transformation of the medical field represents challenges for medical entrepreneurship, and every entrepreneur seeks the best methods to overcome them. However, it is more than evident that advanced technologies have already entered the medical environment. For example, according to specialized studies, 20% of Americans use digital technology for health monitoring [40]. The relationship between leadership and entrepreneurial skills have been proven by many researchers in different fields [41].

Wulfovich and Meyers [7] (p. 1) defined healthcare entrepreneurship as “the pursuit of opportunity under volatile, uncertain, complex and ambiguous conditions to create stakeholder defined value through the deployment of innovation using a valid, automatic, scalable, and time-sensitive business model”.

The qualified resources in the field intend to transfer to the beneficiaries, with mutual interest, the medical know-how circulated through the business environment in market conditions with harmonized variables. Medical entrepreneurs must continuously balance the primordial purpose of entrepreneurship (the pursuit of wealth) and patients' health, which is seen as the ultimate good and their main responsibility. The essence of this field is the interaction with human life [42]. In other words, entities active in the medical field of business are responsible for individuals' health. Chen [43] stated that the culture of medical entrepreneurship must promote the principle that economic gain should not harm the interests of the beneficiaries of the medical act.

The joining of business and medicine seems forced, as Walker and Ko [44] proved which features the training of a doctor and the goals of an entrepreneur have in common: the analytical and problem-solving skills developed as a result of medical training can be fully used in the business environment, the flair, the passion, the digital skills and the use of technology, and, last but not least, the mission to place a brick in building a better world. In the U.S., many university centers in the medical field have intuited that some of their students want to develop their entrepreneurial skills and adequately train them. Consequently, Innovation and Entrepreneurship courses have been introduced in curriculum programs [45].

The main incentive of young people to start a business lies in a strong motivation to become an entrepreneur (i.e., an entrepreneurial model to be followed represents a motivational factor) [46]. The other motivational factor consists of the existence in the family of a pattern that influences people to decide to become an entrepreneur [47]. A hierarchization of factors that motivate young people to launch an entrepreneurial activity was realized by Hrehová [48], and it consisted of the following: the importance of the creative side, the power of a specific idea, followed by the freedom to choose how to lead one's own life, financially earning and realizing their maximum personal potential. Finally, Shi and Wang [49] pointed out that gaining wealth and personal development are the main motivations of people to become entrepreneurs.

Lexa and Lexa [50] analyzed the challenges that radiologists and other medical employees face when they decide to become entrepreneurs. The purpose of the research of Lexa and Lexa [50] was to prepare physician-entrepreneurs for the initial stage of their new business and to motivate them to overcome the barriers and succeed.

Therefore, as a result of the literature review, we elaborated on the following hypotheses:

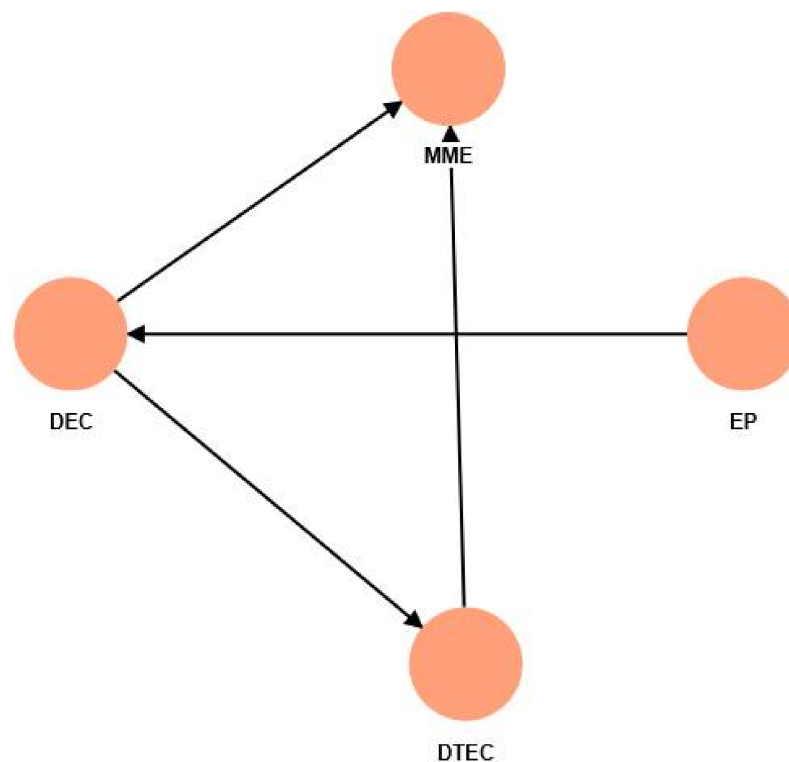
**H1:** *The level of digitalization of the medical field directly and positively influences the usability and availability of new technology (DEC → DTEC).*

**H2:** *The level of digitalization of the medical field directly and positively influences the motivation of young people with a background in the medical field to become entrepreneurs (DEC → MME).*

**H3:** *The usability and availability of new technology directly and positively influence the motivation of young people with a background in the medical field to become entrepreneurs (DTEC → MME).*

**H4:** *The level of awareness by young people with a background in the medical field of their entrepreneurial potential directly and positively influences the level of digitalization of the medical field (EP → DEC).*

Figure 1 reflects the relationship between our variables.



**Figure 1.** The conceptual model.

### 3. Methodology

#### 3.1. The Structure of the Questionnaire

We adapted the questionnaire's items from many research papers [3,5,6,26]. The variables of our research are the following: Assessment of the level of digitalization of the medical field—DEC (4 items); The usability and availability of new technology—DTEC (4 items); Evaluation of the level of awareness by young people with a background in the medical field of their entrepreneurial potential—EP (4 items); and the motivation of young people with a background in the medical field to become entrepreneurs—MME (5 items). A detailed description of the items of the variables is presented in Table 1. In the first stage, the questionnaire was tested on a small group of young people working in medical organizations to identify some confusing items. Finally, after interpreting the results, the questionnaire was distributed online, and we introduced an eliminatory question: Do you have a background in the medical field? If the answer was YES, the respondent continued to fill out the questionnaire. If the answer was NO, the questionnaire was closed. The items were coded on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

**Table 1.** The structure of the sample.

Variables	Frequency	Percent
Gender		
Male	189	47.8
Female	206	52.2
Age		
24 years old	37	9.4
25 years old	28	7.1
26 years old	90	22.8
27 years old	101	25.6
28 years old	45	11.4
29 years old	31	7.8
30 years old	63	15.9
Job in medical field		
YES	262	66.3
NO	133	33.7
Entrepreneurial intention		
YES	314	79.5
NO	81	20.5

#### 3.2. The Sample Particularities and Data Description

We received 428 questionnaires, but only 395 questionnaires registered complete responses. We used a random sampling technique, and we selected participants from young people with a background in the medical field. Data collection was conducted between September 2022 to January 2023. The survey was administrated online using Google Forms. The sample structure is presented in Table 1.

Analyzing the table above, we observe that females are preponderant, but the difference between males and females is not significative. The majority of the respondents manifested their intention to become an entrepreneur.

We analyzed the data using Partial Least Squares Structural Equation Modeling (PLS-SEM) instead of Covariance-Based Structural Equation Modeling (CB-SEM) because the



latent variables are used to explain the relationships between the four variables and not for using maximum likelihood estimation in a complex model.

#### 4. Results

First, we examined the mean (M) scores, the standard deviations (SD), loadings, and the *Variance Inflation Factor* (VIF) through SMARTPLS4 statistical software (Table 2).

**Table 2.** Descriptive Statistics, Outer Loadings, and VIF for items of the variables.

Items	Mean	Standard Deviation	Loadings	VIF
DEC1: Do you use electronic health records to manage patient information and communicate with colleagues?	4.09	0.648	0.767	1.462
DEC2: Do you use telemedicine technology to provide remote consultation and treatment to patients?	3.89	0.581	0.823	1.787
DEC3: Do you use mHealth apps and devices to track and monitor patients' health data?	3.95	0.786	0.828	1.991
DEC4: Are you familiar with data management and analytics to evaluate patient outcomes?	4.13	0.668	0.765	1.734
DTEC1: I believe that the availability of new technology determines me to identify and develop my entrepreneurial competencies in the medical field	3.83	0.670	0.838	1.959
DTEC2: I believe that the accessibility of new technology determines me to identify and develop my entrepreneurial competencies in the medical field	3.84	0.701	0.842	1.904
DTEC3: I believe that the use of new technology will lead to a decrease in healthcare inequity, especially for rural communities and the elderly, and this is one reason that leads me to identify and develop my entrepreneurial competencies in the medical field	3.88	0.698	0.831	2.100
DTEC4: I believe that using of new technology will improve my medical practices	3.92	0.706	0.709	1.378
EP1: Do you know about medical entrepreneurship?	4.06	0.672	0.774	1.655
EP2: During your studies in the medical field, did you attend courses or other forms of training in the field of entrepreneurship?	3.90	0.607	0.872	2.580
EP3: Do you think entrepreneurship courses should be included in medical curricula?	4.00	0.776	0.833	2.176
EP4: Do you think you have enough knowledge to become an entrepreneur in the medical field?	4.02	0.732	0.904	3.283
MME1: To improve the relationship between medical employees and patients	4.21	0.604	0.858	3.119
MME2: To create new business opportunities in the healthcare sector	4.10	0.586	0.890	4.755
MME3: To acquire new competencies in complementarity with medical competencies	4.08	0.583	0.869	4.603
MME4: To gain greater professional independence	4.18	0.575	0.840	2.635
MME5: To improve my financial situation	4.19	0.577	0.903	4.184

Source. SPSS and SMARTPLS4 software.

The respondents indicated a high agreement with the variable items, and the highest mean scores were registered for MME1 (M = 4.21), proving that the relationship between medical employees and patients is the primary motivational factor for young people to become entrepreneurs. On the other hand, the lowest mean scores were registered for DTEC1 (M = 3.83), underlining those human relations are primordial in developing young people's entrepreneurial competencies in the medical field and, after that, is positioned the availability of new technology.

The values of the standard deviation (SD) varied from 0.575 (for MME4) to 0.786 (for DEC3), indicating convergent opinions related to professional independence given to

young people by entrepreneurship and divergent opinions related to using mHealth apps and devices to track and monitor patients' health data.

The loadings range from 0.700 to 0.904 (above 0.700), and the variance inflation factors (VIFs) range from 1.378 to 4.184, proving that multicollinearity is not an issue for our model) [51,52].

The construct reliability and validity are presented in Table 3.

**Table 3.** Construct reliability and validity.

	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
DEC	0.808	0.814	0.874	0.634
DTEC	0.819	0.827	0.881	0.651
EP	0.867	0.870	0.910	0.718
MME	0.921	0.924	0.941	0.761

Source. SMARTPLS4 software.

The composite reliability values were higher than 0.5, ranging from 0.814 to 0.924, proving evidence of discriminant validity as the square root value of AVE that is greater than the correlation values among the latent variables [53].

The values of Fornell-Larcker criterion are presented in Table 4 and prove the presence of discriminant validity.

**Table 4.** Fornell-Larcker criterion.

	DEC	DTEC	EP	MME
DEC	0.746			
DTEC	0.420	0.707		
EP	0.741	0.366	0.747	
MME	0.417	0.357	0.396	0.732

The heterotrait-monotrait (HTMT) re-confirmed the presence of discriminant validity as the correlated values were lower than the 0.9 threshold (Table 5) [54].

**Table 5.** Heterotrait-monotrait ratio (HTMT).

	DEC	DTEC	EP	MME
DEC				
DTEC	0.509			
EP	0.721	0.431		
MME	0.464	0.408	0.445	

We introduced other essential criteria for checking the structural model. R-Squared (R<sup>2</sup>) values are relatively strong (i.e., are above 0.5 and ranged from 0.717 for MME to 0.741 for DEC) and prove a high level of correlation. On the other hand, effect size (f<sup>2</sup>) is below 1 and ranges from 0.051 for the relationship between DTEC-MME to 0.215 for the relationship between DEC-DTEC.

The model fit measurement of the variables proves they are satisfactory because the values of goodness of fit (GoF) indices for models' measurement (SRMR is 0.045, and the value of NFI is 0.946) demonstrate that there are no collinearity problems. Therefore, our PLS-SEM model provides a pertinent answer to the study's objectives.

Our findings prove that the particularities of medical entrepreneurship are strongly influenced by new technology because it generates a specific business model which involves much technical knowledge in the medical field. Meanwhile, the medical crises



(i.e., the COVID-19 pandemic) generated new entrepreneurial opportunities for the business environment, developing medical and social entrepreneurship based on new technology. Therefore, the employees from the medical field concluded that it is necessary to support, develop and cover the existing gaps in the global health system by providing high-quality services and products covering a wide range of activities (i.e., medical tourism, development of medical technology, development of medical devices and equipment, digitization services of medical entities, provision of know-how, medical marketing, and holistic medicine clinics).

We must pay attention to the fact that, regardless of the degree of digitization of healthcare, the relationship between medical and patient employees will be one based on direct interaction and effective communication.

Table 6 summarizes the results the total effects of our research model that prove the status of the hypotheses.

**Table 6.** The status of the hypotheses.

Hypotheses	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	p-Values	Status of Hypothesis
H1: DEC -> DTEC	0.420	0.423	0.043	9.668	0.000	Validated
H2: DEC -> MME	0.324	0.324	0.059	5.465	0.000	Validated
H3: DTEC -> MME	0.221	0.222	0.050	4.415	0.000	Validated
H4: EP -> DEC	0.861	0.862	0.035	24.594	0.000	Validated

Source. SMARTPLS4.

Analyzing the above table, we observe that digitalization of the medical field has a positive impact on the usability and availability of new technology, and this finding is consistent with previous research [5,55–58]. Consequently, the level of digitalization in the medical field and the usability and availability of new technologies represent motivational factors for young people with a background in the medical field to become entrepreneurs.

Digital technology is used in the medical field to take over from the repetitive and routine activities of medical staff and that lead to the reduction of the medical staff's interest in those activities that give meaning to the medical act and the relationship between the medical staff and patients.

Rivas [59] observed that, at the global level, no actions were taken to promote the entrepreneurial spirit in the medical curriculum, vision, or core values of medical universities and associations.

## 5. Discussion and Conclusions

The findings led us to the conclusion that the medical sector now offers a huge opportunity for young people with a background in this domain to develop their entrepreneurial competencies. Therefore, the managers of medical organizations must pay attention to the fact that, regardless of the degree of digitization of their organization, the relationship between employees in the medical field and patients will be one based on direct interaction and effective communication [60,61].

Digital technology is used in the medical field to take repetitive and routine activities from the medical staff that reduce the medical staff's interest in those activities that give meaning to the medical act and the relationship between the medical staff and patients.

### 5.1. Theoretical Implications

The pandemic generated by COVID-19 has emphasized the importance of complex training and the complementation of medical school graduates, who, in addition to medical skills, should be provided with training in digital entrepreneurial competencies. We contribute to research on digitalization and the motivation of young people with a background in the medical field to become entrepreneurs. The level of digitalization in the medical field

is not only a motivation for young people with a background in the medical field, but also a challenge for new startups.

The other theoretical contribution is related to the degree of the usability and availability of new technology that is perceived as a driving factor for young people because they consider that, in the future, it will be compulsory for people working in the medical field to use digital technologies for improving the communication process and the relationship between medical employees and patients.

### 5.2. Managerial and Practical Implications

We recommend that managers of healthcare organizations and decision-makers in medical universities capitalize on the digital and entrepreneurial potential of young people for whom digital technology is an ordinary tool in their daily activities.

In the healthcare sector worldwide, access to medical acts is conditioned by financial resources (i.e., medical insurance), and digital entrepreneurship in this field can provide a high social impact through some innovative solutions that will assure direct access for patients to medical acts.

### 5.3. Research Limitations and Further Research

The research's limitations consist of the sample's dimension and the analysis of one domain (i.e., the medical field). However, these limitations allow us to extend future research to study the impact of digital technologies on other domains related to the medical field.

Our study investigated the impact of digitalization and new technology on the desire of young people with a background in the medical field to become entrepreneurs. We identified the relationship between digital and human resources variables, but we did not analyze the factors that represent barriers to developing the entrepreneurial spirit of young people from the medical field. This limitation will represent a motivation for future studies that will explore young people's perception of the necessity to develop their entrepreneurial competencies during scholarship and to effectively use the new technologies in the medical act.

Other future research will be devoted to evaluating the relationship between digital competencies and the performance of employees from the medical field.

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