

# OPPORTUNITIES AND CHALLENGES FOR ICT-BASED ENTREPRENEURSHIP IN INDIA: SPECIAL REFERENCE TO INDIAN HEALTHCARE INDUSTRY

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## ABSTRACT

### OBJECTIVE:

This study investigates the potential of technology entrepreneurship to address critical challenges within the Indian healthcare landscape. Leveraging existing literature, we develop a novel theoretical framework examining how patients, medical professionals, and the healthcare industry interact with three key elements of technology entrepreneurship: technology innovation, technology proactivity, and technology risk-taking. Analysing these interactions across three tiers – patients, medical professionals, and the industry itself – reveals practical implications for fostering positive change.

### DESIGN / METHODOLOGY:

The authors have conducted an extensive review of literature focusing on technological growth in the healthcare industry and its effect on entrepreneurship development in this area. The review is primarily focused on developments in the last two decades. Consequently, the authors have proposed a framework for technology entrepreneurship development (i.e., technological innovation, technological proactivity, and technological risk-taking), which is the foundation of value creation. This concept will be dealt with at three levels, namely, patients, medical professionals and hospitals, and the entire healthcare industry.

### RESULTS:

Many researchers have identified that innovation, proactivity, and risk-taking are the key characteristics of the entrepreneurial journey. Each of these characteristics (innovation, proactivity, and risk-taking) has been explained with supporting examples from the healthcare industry. The paper's practical implications can be separated into three categories: those for patients (support for patients and technology-based engagement techniques), organizations (digital health solutions and collaborative motivation), and the healthcare industry (infrastructure and trust building).

### CONCLUSION:

The paper has outlined the challenges and opportunities for technology entrepreneurs at three levels, namely, patients, medical professionals and hospitals, and the entire industry. Prospects for research in the near future have been also identified.

### KEYWORDS

Healthcare entrepreneurship, technology entrepreneurship, entrepreneurship in healthcare technology, new technologies in healthcare, healthcare technologies in India.

## INTRODUCTION

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Information and Communication Technology (ICT) permeates various business sectors in India, offering immense potential for transformation. The healthcare sector, plagued by limited access to affordable care and uneven distribution of resources, presents a compelling opportunity for technology-driven interventions. With a population of 1.3 billion and a skewed urban-rural healthcare infrastructure, India demands innovative solutions to bridge the gap between demand and quality care [1,2].

### TECHNOLOGY ENTREPRENEURSHIP: A CATALYST FOR CHANGE

Technological entrepreneurship in healthcare refers to the establishment and expansion of enterprises offering novel solutions to improve healthcare delivery [3]. Driven by increasing societal demand, stricter regulations, and a growing need for efficient services, the healthcare industry requires innovative approaches to address rising patient numbers and ensure personalized, high-quality care amidst resource constraints [4].

While numerous studies have explored the healthcare sector through diverse social science lenses (marketing, organization studies, economics), a holistic framework integrating various perspectives remains elusive [5]. This research aims to address this gap by developing a novel framework grounded in the interactions between key stakeholders (patients, medical professionals, and the industry as a whole) and the following three critical elements of technology entrepreneurship:

- **Technology Innovation:** Development and adoption of novel technologies to enhance healthcare delivery.
- **Technology Proactivity:** Anticipating and proactively addressing evolving healthcare needs through technology.
- **Technology Risk-Taking:** Embracing calculated risks associated with implementing new technologies for potential advancements.

This research uses a framework of multi-tiered analysis, which analyses technology entrepreneurship across three tiers: patients, medical professionals, and the healthcare industry. The first tier of analysis examines how technology can enhance patient support, engagement, and empowerment through innovative solutions. The second tier explores how digital health tools and collaborative platforms can empower medical professionals and foster teamwork. The third tier investigates how technology entrepreneurship can contribute to infrastructure development, trust building, and improved service delivery within the healthcare system. This analysis yields valuable insights for various stakeholders. For the healthcare sector, it emphasizes the need for infrastructure development, trust building, and data security considerations alongside technology adoption. For organizations, this analysis highlights the importance of implementing digital health solutions, fostering collaborative cultures within healthcare organizations, and supporting technology entrepreneurs. For patients, it underscores the value of patient-centric technology design, promoting patient engagement strategies, and ensuring ethical considerations in data use.

### ENTREPRENEURIAL ATTRIBUTES IN HEALTHCARE TECHNOLOGY: CREATIVITY, PROACTIVITY, AND RISK-TAKING

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This research article explores three critical attributes shaping the entrepreneurial journey in healthcare technology: creativity, proactivity, and risk-taking. By examining these characteristics and their practical applications within the Indian healthcare landscape, we aim to shed light on the essential qualities driving innovation and positive change in this dynamic field.

#### CREATIVITY: FUELLING INNOVATION IN HEALTHCARE TECHNOLOGY

Technological innovation forms the bedrock of advancements in healthcare, enabling the development of novel solutions to tackle existing challenges and enhance patient care. Defined as the process of creating, implementing, and utilizing new or improved technology, innovation encompasses a wide range of products and services designed to optimize patient outcomes, reduce costs, and streamline clinical procedures [6]. The healthcare technology landscape thrives on the contributions of both large organizations and small and medium-sized enterprises (SMEs). While large corporations

often leverage research-based forecasting and advanced data analytics tools like IBM Watson for drug discovery, fraud detection, and healthcare administration [7]. SMEs play a crucial role in fostering agility and bringing innovative solutions to the market. In a testament to the power of creativity, the collaboration between Apollo Hospitals and India Medtronic has yielded an AI-powered stroke treatment solution capable of reducing diagnosis time from 60 minutes to 2 minutes, highlighting the immense potential of creative approaches to improve patient outcomes.

### **PROACTIVE APPROACH: ANTICIPATING AND ADDRESSING HEALTHCARE NEEDS**

Technology proactivity—defined as the anticipatory use of technology to address emerging challenges before they materialize—empowers the healthcare sector to prepare for and effectively manage evolving demands [8]. Predictive analytics, early disease detection systems, and healthcare automation represent key applications of proactive technology. These tools aim to safeguard population health, identify individual medical anomalies, and generate future projections at both individual and societal levels. Additionally, technology proactivity can promote sustainable healthcare practices by enabling hospitals to adopt innovative and cost-effective service delivery models [9]. The social aspect of technology entrepreneurship plays a pivotal role in fostering collaboration between market players and internal/external resources, which is particularly relevant in the healthcare industry due to its inherent focus on tackling medical challenges [10]. An illustrative example is Wadhvani AI's development of an innovative triaging tool that utilizes self-reported symptoms and analyzes cough sounds to identify potential COVID-19 cases. This project, in collaboration with various government agencies, exemplifies the proactive use of technology to optimize resource allocation and improve testing reach during the pandemic.

### **RISK-TAKING: EMBRACING CHALLENGES FOR VENTURE CREATION**

Entrepreneurship inherently involves calculated risk-taking. However, in the healthcare industry, decisions made by entrepreneurs and stakeholders impact not only themselves but also patients and healthcare providers. Doctors take risks by participating in trials of new technologies or services, while patients may choose to undergo innovative treatments if the potential benefits outweigh the risks associated with established approaches. Hospitals, too, face potential reputational and operational challenges if they are unprepared to manage risks associated with innovative solutions. In this complex ecosystem, all stakeholders – entrepreneurs, providers, and patients – must exhibit a degree of risk tolerance and decision-making ability [11,12]. Building trust within the healthcare industry requires transparent communication, a demonstrably robust safety net, and a proven track record of success, as evidenced by experience, expertise, and positive referrals.

## **VALUE CREATION IN HEALTHCARE TECHNOLOGY: OPPORTUNITIES AND CHALLENGES ACROSS STAKEHOLDERS**

This section delves into the multifaceted interplay between value creation, challenges, and opportunities in healthcare technology at the patient, organizational (hospitals and medical personnel), and healthcare sector levels.

### **PATIENT-LEVEL**

Opportunities:

- Predictive Health: Companies like Google leverage data to predict long-term health trends, while other companies like Practo, Pharmeasy, and Tata 1mg focus on analyzing activity and capture data for personalized insights [13].
- Remote Patient Evaluation: Technologies like Dectrocel Healthcare's AI-based medical imaging facilitate early diagnosis, while Ubicare and HealthifyMe assist with chronic disease management. [13].
- Treatment Monitoring: Solutions for medication reminders, drug discovery, and family involvement are emerging, and help to enhance treatment adherence and support. [14].

Challenges:

- Data Privacy and Security: Balancing personalization with data protection remains crucial [14].

- Access and Affordability: Ensuring equitable access to technology across diverse socioeconomic backgrounds is essential. [14].
- Digital Literacy: Bridging the gap between patients' computer skills and technology utilization requires ongoing education. [13].

## ORGANIZATIONAL-LEVEL

### Opportunities:

- Enhanced Diagnostics: Startups like Phase Laboratories and Aduvo Diagnostics address specific healthcare challenges through innovative diagnostic tools [14].
- Improved Treatment and Care: MedMarvel Software Solutions empowers neurologists with advanced imaging tools, while telemedicine platforms like Apollo 24x7 and Medibuddy facilitate remote consultations and reduce infection risks [13].
- Decision Support and Precision Medicine: PierianDx leverages AI to interpret complex genetic data for personalized treatment plans, while HealthPlix's AI-powered EMR platform supports clinical decision-making. [15].

### Challenges:

- Infrastructure and Training: Equipping healthcare providers with necessary infrastructure and training to efficiently utilize new technologies is critical [13].
- Integration and Interoperability: Ensuring seamless integration of diverse technologies within existing healthcare systems remains a challenge. [15].
- Workforce Reskilling: Addressing potential job displacement and empowering healthcare professionals to adapt to changing roles is crucial. [13].

## HEALTHCARE INDUSTRY-LEVEL

### Opportunities:

- Big Data Insights: Analyzing vast datasets, including unstructured data, unveils opportunities for identifying disease patterns, optimizing resource allocation, and developing targeted interventions [15].
- Data Sharing and Collaboration: Secure data sharing across stakeholders can foster collaborative research and innovation, driving industry-wide advancements. [14].
- New Business Models: Data-driven insights can inform the development of innovative value-based healthcare models that prioritize patient outcomes. [14].

### Challenges:

- Data Governance and Regulations: Establishing robust data governance frameworks and ethical regulations is crucial to ensure responsible data use and privacy protection. [13].
- Equity and Accessibility: Bridging the digital divide and ensuring equitable access to data-driven healthcare solutions remains a significant challenge [14].
- Interoperability Standards: Establishing standardized data formats and interoperability standards is essential for seamless information exchange across healthcare systems [15].

## HEALTHCARE TECHNOLOGY ENTREPRENEURSHIP: CHALLENGES AND OPPORTUNITIES

This article's main contribution is an assessment of the many facets of innovation and knowledge in the healthcare industry. Several aspects of technology entrepreneurship are discussed, especially how it creates a value framework for understanding value creation processes in the healthcare industry. The current technological status based on this approach, entrepreneurship in healthcare has been investigated and related to a multi-level framework of challenges and opportunities. Table 1 presents our framework, which is discussed in the next paragraph in terms of its theoretical and practical implications.

At the macro level, trust in technological proactivity is lacking in new products and institutional gaps continue to exist. At the same time, innovative technological tools are being created, which are capable of collecting data from patients and conducting data evaluation [16]. Additionally, the micro-level information collected from numerous patients may serve as the foundation for creating long-term trends in emerging societies, as well as the formation of specialist markets. The proactive production of technical value will increase the provision of medical treatment in underserved areas, emerging nations, and remote locations, ultimately influencing a country's macroeconomic growth [17]. Technology entrepreneurs also contribute value to health organizations by tackling issues such as the lack of medical specialists, an overburdened workforce, and the unproductive use of time by healthcare workers. Overall, technology entrepreneurs provide plenty of possibilities for proactive creation of value to the sector.

**TABLE 1: CHALLENGES AND OPPORTUNITIES FRAMEWORK**

	Technology innovation		Technology proactivity		Technology risk-taking	
	Challenges	Opportunities	Challenges	Opportunities	Challenges	Opportunities
<b>Patient level</b>	Low awareness; refusal to accept automated medical treatments. [1,19]	Service co-creation in close collaboration with patients [17,18]	Patients' lives are disrupted; patients' needs are underestimated. [4,19]	Long-term health advantages are anticipated; supporting gradual rather than abrupt behavioural changes; and practising preventive medicine. [9,20]	Individual risk perception is influenced by personal preferences. [1,16]	Collaboration with industry specialists during the development, testing, and integration stages; protocol creation and standardisation. [6]
<b>Organization level</b>	Resisting new technological solutions; raising certification standards. [17]	Evidence-based trust; increased work efficiency and decreased workload; professional skill development over a career. [12]	Risk to reputation. [9]	To compensate for a shortage of medical professionals, a huge dataset is used to support assessments, and the workload is reduced. [9,17]	Medical workers are being replaced by machines. [6,9]	Creating value in collaboration with risk-tolerant stakeholders; optimising decisions. [9,10]
<b>Industry level</b>	Product complexity. [19,21]	Data is the industry's new source of collective knowledge. [6,19]	Emerging market institutional gaps. [18,19]	Developing long-term plans for industrial growth; institutionalisation and establishment of specialist markets. [19,20]	Unplanned third-party access to medical data [15,20]	Increasing the number of risk-averse investors. [13,18]

Finally, we examine technological risk-taking in terms of the hurdles and possibilities for value creation in the healthcare industry. Individual attitudes and dispositions towards healthcare impact risk perception. Another concern that is associated with technology driven healthcare solutions is that of data security and cybersecurity. There exists the threat of unauthorized access to large sets of patients' data and hence it is important for organizations to ensure that required precautions for data security are taken so that organizations can run smoothly with technology-driven solutions [21].

## PATIENT-LEVEL: PATIENT ADVOCACY AND TECHNOLOGY-ENABLED ENGAGEMENT STRATEGIES

Patient participation in the process of developing technology-driven solutions ensures that the solutions developed are in accordance with the needs of the patients [22]. The involvement of patients during product development can bring out creative solutions and also motivates entrepreneurs to improve their design during product development. Transparent communication is the key to enabling patient engagement during the process of creating technology-enabled solutions. Better communication among patients and technology providers builds patients' confidence in the technology and hence improves their participation. Efficient communication allows patients to freely express their opinions and concerns, which is helpful for healthcare experts during diagnosis and treatment.

## ORGANIZATION-LEVEL: DIGITAL HEALTH SOLUTIONS AND MOTIVATION FOR COLLABORATION

At the organizational level, e.g. in hospitals, patient care can be improved by using technology and digital healthcare solutions. The use of electronic medical records (EMRs) allows medical personnel such as doctors, nurses, and support staff, to monitor patients' medical histories and health conditions in a convenient way. Moreover, technology may aid hospitals in better managing their resources and saving costs through the automation of administrative processes such as appointment scheduling, billing, insurance claims processing, and performance metrics tracking [23]. Additionally, hospitals may also use technology to construct telemedicine systems that allow patients to contact their physicians remotely while receiving medical advice and treatment online. Finally, virtual reality simulations may be developed utilizing technology, allowing physicians and nurses to practice medical procedures in a safe and controlled environment. An important area of research is motivation for hospital-level collaboration. Financial incentives, corporate share transfers, and board of directors' participation are all well-studied issues. Intangible assets, at the same time, may be just as valuable [24].

## INDUSTRY-LEVEL: TRUST BUILDING AND INFRASTRUCTURE

Another prominent area for academic research is the issue of development of trust among market actors. When engaging with healthcare sector experts, it is recommended that greater attention is devoted to practical processes and real ideas for technology entrepreneurs [20].

A sustainable healthcare business requires solid infrastructure that serves society as a whole, and not just a few individuals. Healthcare is rarely considered by entrepreneurs from other sectors because of its complexity and overregulation [25]. Further research (Table 2) is therefore required to understand the effect of digital infrastructure on healthcare technology entrepreneurship.

**TABLE 2: FUTURE RESEARCH AVENUES**

	Key topics	Future research
Patient-level [18,26]	Patients' needs identification; building trust between patients and entrepreneurs.	Investigating the domain of patient support and its related implications.
	Proper communication with patients in order to anticipate their needs; increased patient participation in technology-enabled diagnosis.	Researching the enhancement of patient involvement using digital technology.
Organization-level [7,13,25]	Telemedicine solutions, virtual reality simulations, automated administrative activities and accesses of patient history can be developed as a part of enhanced digital health solutions.	Researching the impact of digital health solutions with a focus on increased efficiency, improved efficacy, and better implementation.

	Encouraging leaders and motivators to advance the use of digital technology in healthcare activities.	Researching the journey of digital technology solutions and their implications.
Industry-level [13,25,27]	Building trust by coping with institutional constraints and negotiating competing reasons.	Understanding how trust can be built and maintained at the healthcare industry level while taking into account the complexities of a multi-stakeholder situation in which various players have different interests.
	Encouraging private players and ensuring that regulations are reviewed.	Exploring the relationship between infrastructure development and healthcare entrepreneurship.

## CONCLUSION

Technology entrepreneurship can benefit the healthcare sector in India because it solves some of the fundamental challenges related to healthcare by giving more power to users and building innovative worth-creation systems. This paper demonstrates how combining creative thinking with proactive approaches and risk management at various levels enables technology entrepreneurship to resolve healthcare access inequalities, delivery inefficiencies, and quality deficiencies, among other complex obstacles. Forecasted medical insights coupled with remote diagnostic tools and personalized care are among the benefits that technology provides to patients, but such improvements require strong data privacy measures and user education. Organizations can also benefit from improved diagnostics along with telemedicine and AI-supported decision systems. However, they need to establish proper infrastructure and teach their workers new skills and establish cross-departmental working relationships. In the healthcare industry, big data analysis with innovative business strategies creates both macroeconomic potential and fair patient services through well-established rules and strong reputation-building frameworks.

This study demonstrates how technology entrepreneurship plays an essential function in changing India's healthcare system. The analysis of value creation opportunities and challenges across different levels of stakeholders underscores the transformative potential of technology, while also highlighting the inherent complexities related to data privacy, infrastructure development, and ethical considerations. All stakeholders must collaborate to create an environment favorable for technology adoption because they face significant challenges related to trust, along with data security and digital literacy needs. This study presents implementable guides for both business owners and policy creators through its analysis of patient support systems and joint organizational ventures, along with industrial trust-building initiatives.

## FUTURE RESEARCH

Future research could explore specific examples of technological innovations within each tier of the presented framework and their impact on stakeholders. Additionally, quantitative and qualitative studies could assess the effectiveness of specific technology-driven interventions in different healthcare settings. Further research could also explore the specific skills and competencies required to cultivate specific attributes within healthcare entrepreneurs. Comparative studies examining the risk-taking profiles of entrepreneurs in different sub-sectors of healthcare technology could also offer valuable insights. Additionally, investigating the role of policy and regulatory frameworks in encouraging or hindering the development of different attributes within the healthcare landscape could inform the creation of more supportive environments for innovation.

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