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# THE FUTURE OF HEALTH TECHNOLOGIES AND MANAGEMENT SYSTEM IN BRAZIL: WHAT'S NEXT?

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**Resumo**

As tecnologias em saúde evoluem dia a dia em um caminho promissor Hospitais não sobrevivem sozinhos, pois grande parte das mudanças que a transformação digital demanda compartilhamento de conhecimento e interação com o ambiente externo - ou seja, interações com instituições públicas e privadas, parceiros, artefatos, provedores, etc Ecossistemas de saúde são um ambiente complexo e dinâmico com atores interdependentes, não hierarquicamente dependentes, que realizam atividades e cooperam para criar e capturar valor, em favor de diversos produtos de inovação No entanto, mesmo com o ritmo acelerado de transformação digital neste ambiente , muitos hospitais não conseguem prever "o que vem a seguir", como internalizar essas tecnologias e adaptar seu sistema de gestão ao futuro Como o ambiente hospitalar é complexo e as tecnologias emergentes são muito incertas, a análise das tendências hospitalares é uma forma de lidar com uma série de variáveis ??que estão além do nosso controle, mas que podem de alguma forma nos ajudar a entender as tendências futuras que pode impactar hospitais. Isso que pretendemos explorar nesse artigos sobre as tendências no ecossistema de saúde para os próximos 10 anos.

**Palavras-chave:**Previsão. Delphi. Tecnologias em saúde. Sistema de gestão. Inovação em saúde. Health trends.

**Abstract**

Health technologies evolve day by day on a promising path Hospitals do not survive alone, as most part of the changes require for digital transformation demands knowledge sharing and interaction with the external environment - that is, interactions with public and private institutions, partners, artefacts, providers, etc Health ecosystems are a complex and dynamic environment with interdependent actors, not hierarchically dependent, who carry out activities and cooperate to create and capture value, in favor of various innovation outputs However, even with the fast pace of digital transformation in this environment, many hospitals fail to predict “what is next”, how to internalize these technologies and adapt their management system to the future As the hospital environment is complex and emerging technologies are very uncertain, the analysis of hospital trends is a way to deal with a series of variables that are beyond our control, but that can somehow help us understand future trends that may impact hospitalsThis is what we intend to explore in this article on trends in the health ecosystem for the next 10 years.

**Keywords:** Forecasting. Delphi. Health technologies. Management system. Health innovation. Health trends.

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# The future of health technologies and management system in Brazil: what's next?

## 1. Introduction

Health technologies evolve day by day on a promising path. Hospitals do not survive alone, as most part of the changes require for digital transformation demands knowledge sharing and interaction with the external environment - that is, interactions with public and private institutions, partners, artefacts, providers, etc. Health ecosystems are a complex and dynamic environment with interdependent actors, not hierarchically dependent, who carry out activities and cooperate to create and capture value, in favor of various innovation outputs.

However, even with the fast pace of digital transformation in this environment, many hospitals fail to predict "what is next", how to internalize these technologies and adapt their management system to the future. As the hospital environment is complex and emerging technologies are very uncertain, the analysis of hospital trends is a way to deal with a series of variables that are beyond our control, but that can somehow help us understand future trends that may impact hospitals.

During the initial incorporation of a new technology into a stablished hospital, actors may lack access to information and evidence regarding the viability of the technology and its long-term sustainability. Second, the emerging technology needs to address various stakeholders across multiple markets and industries (Thomas & Ritala, 2021). Heath trend experts may face doubts regarding the technological, economic, and cognitive independencies that might be necessary to implement the new technology. They may depend on cooperation from strangers to deliver a still incipient value proposition to the market (Dattee et al., 2018). Third, the value proposition is incipient in its early stages as there is still no full acceptance by technology users. These outputs are usually related to the increase of life expectancy rates, decrease in the number of deaths, reduction in patient care time, increment of the processes operational efficiency.

Uncertainties are even more pronounced in technologies from nascent industries. When the new technologies are born in nascent industries (for example, patients' tele-rehabilitation through digital games), the challenges associated with the implementation of this technologies inside a hospital are a challenge.

In this scenario, forecasting can help to reduce the uncertainty of the environment, the risk in the orchestrator's decision making and increase the predictability of the actions to be taken to reach the designed value proposition. The strategic planning school appears in the literature to guide managers to carry out predictive analysis of future situations. A number of thinkers contribute to the formation of the planning school: Planning and positioning (Ansoff, 1979), competitive analysis (Porter, 1980), real options (Mc Grath, 1999), scenario planning (Schoemaker, 1995; Schwartz, 1997; Godet, 1997).

The Delphi method enables the identification of trends and future events based on the structured use of expert knowledge through the identification and rank of expert's ideas. Therefore, this research aims to understand how the Delphi Method can help create an ecosystem's value proposition for the evolution of an innovation ecosystem. Through experts' interviews, we identify the future for Health technologies in Brazil over the next 10 years, as well as the main changes in heath system for the same time period.

This work is structured as follows. First (Section 2.1), we present a brief explanatory session on the theoretical origins of strategic management, bringing together some authors who have contributed to consolidate the importance of predictive analytics in the field of business administration studies. Second (Section 2.2), we present some information and data related to the health sector in Brazil. Next, Section 3, we present the methodology of this study. In the Section 4, we present the main results of the Delphi followed by the conclusion (Section 5).

### 2.1 The School of Strategic Positioning: Planning to Manage Uncertainties and Risk

Strategy literature has evolved over the last 60 years and is divided into different approaches. Between 1960 and 1970, the focus of the strategy was directed towards the external environment. This stream analyzed the external environment of organizations based on their market power, arguing that the structure of an industrial company is a determining factor in its competitive performance. Several authors have shown planning as a weapon for managing uncertainty, as can be seen in the works of Porter (5 Porter's Forces, 1985 and later Porter's Value Chain, 1985), Portfolio Planning Matrix (Hedley, 1977), Product Lifecycle (Levitt, 1965) Strategic Environment Matrix (BCG, 1980). This stream of strategy theory argues that industry

determines company profits and that planning is a deliberate, rational and conscious analysis. (Hedley, 1977; Porter, 1985; Andrews, 1976). This stream argues that entrepreneurs must act in these environments to better deal with uncertainties through structured planning.

These authors understand that researchers in this line assume that the environment is under their control and is predictable, emphasizing planning. They argue that forecasting increases the chances of success of an enterprise exposed to uncertain environments, as it contributes to the identification of resources that will be valuable in the future. Forecasts help to project possible future scenarios by predicting various internal, micro and macro-environmental aspects - for example, responses from suppliers, customers to a trend, opportunities and market threats. These authors believe that forecasting increases a company's chances of success. The assumption behind this idea and present in these approaches is that what can be predicted can be controlled (Wiltbank et al., 2006). The planning school sees the ability to correct routes and take corrective actions as the most effective way to control uncertain environments (Wiltbank et al., 2006). Figure 1 shows Planning as a way to think when prediction ability is high.

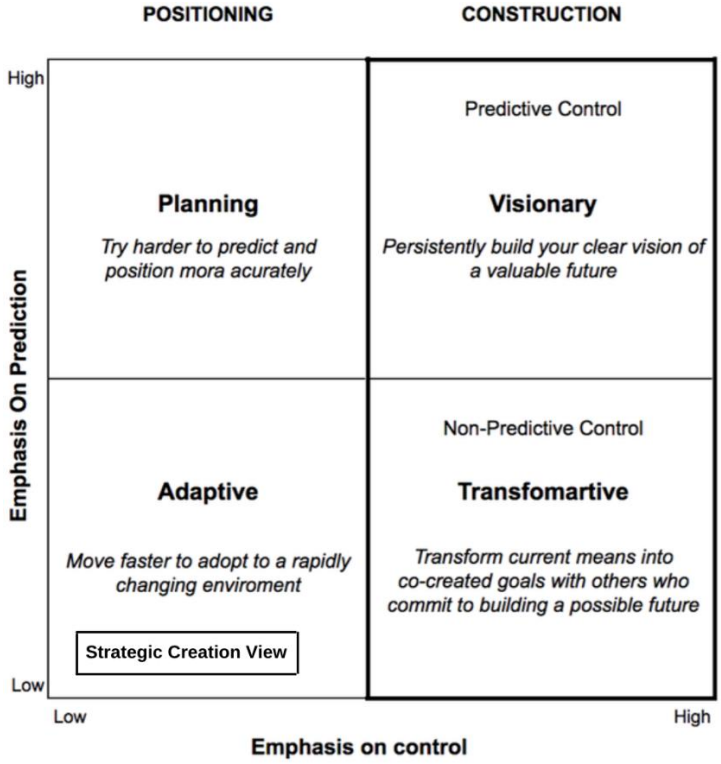


Figure 1 – The Planning School.
Source: Adapted from Wiltbank et al. (2006)

Below we present an overview of the health sector and hospitals in Brazil.

## 2.2 Health Ecosystems in Brazil

According to the study PWC Accelerating the health economy of tomorrow (2021), the pandemic highlighted the link between public health and the health of national economies, bringing the need to change the nature of health systems and their modus operandi with the acceleration of the New Health Economy. The elements of the New Health Economy were built towards a modular ecosystem of delivery, innovation, and well-being more connected to the consumer and the pandemic has increased the speed of this transformation, with the main accelerators being considered as: health virtualization, data-based modeling, improved supply chain, and social reprioritization of health determinants.

The virtualization in treatments approaches was urgent in pandemics times, doctors and health providers adopt it in a quickly way but, the future of this method is not clear. In USA, the majority of patient consultations are now happening virtually. It´s a big transformation in a short period of time, but the real question is if it will stay like that after the pandemic end. There is a lot of doubts about how to have a good clinical exam and how to track the patient information to lead a good diagnosis or how health providers like health insurance will pay for virtual consul and even regulatory barriers (Webster, 2020, p.1180).

An important aspect about the health ecosystem is about doctors and health workers, the health system doesn't exist without them and, here in Brazil we've never had so many doctors per thousand inhabitants (2,4/1000). This high number of doctors is due to the growth of medical universities, but there is a question about the quality of education. Another aspect is about the great dissatisfaction of population with health services, this suggest that there is a lot to improve to achieve efficiency (Scheffer, 2020, p. 13-14).

Below we present the methodological steps that guided this project.

## 3. Methodology

Technology forecasting is focused on changes in the systematized knowledge applied to alter, control, or order systems of analysis, regulation, management and can be adopted to foresight capability growth, technology replacement, market penetration, diffusion and technology breakthroughs (Roper et al., 2011). The Delphi method is a flexible research technique that allows the anonymity of participants, iteration, controlled feedback, and quantitative analysis of data. The typical Delphi process starts with the development of a research question, design and sample and is constituted by three rounds of a Delphi

questionnaire design, survey, and analysis. The first round also can include a pilot for Delphi questionnaire testing and adjusting (Skulmoski and Hartman, 2007). Figure 2 presents the Three Round Delphi Process as proposed by Skulmoski and Hartman (2007).

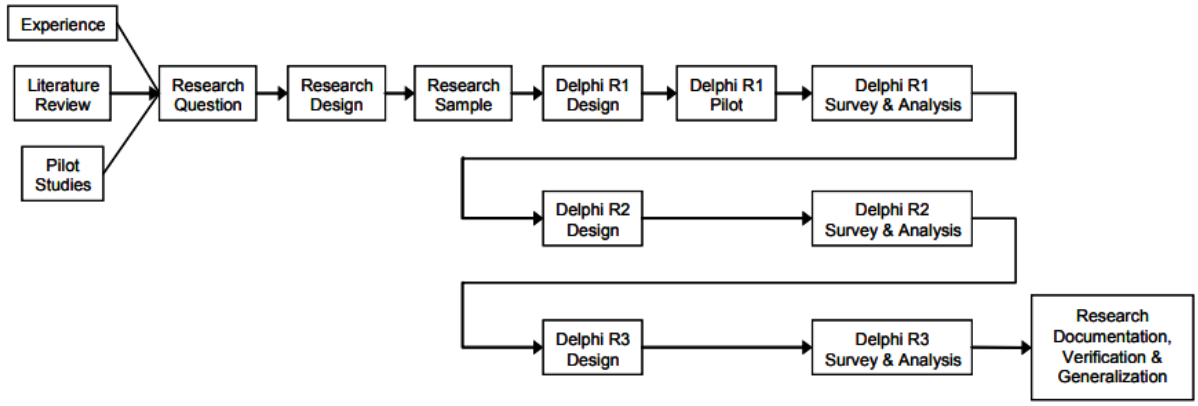


Figure 2: Three Round Delphi Process
Source: Skulmoski and Hartman (2007)

Considering this process, the research questions were defined based on Health Ecosystems in Brazil literature review and the study PWC Accelerating the health economy of tomorrow (2021) aiming to identify the value proposition for the evolution of an innovation ecosystem considering the next 10 years: 1) Q1. What new trends in health technologies will be present in Brazilian hospitals? 2) Q2. How should they impact the management system of these hospitals?

The research questions were validated with the supervision of the specialist Renata Giovinazzo Spers, PhD in Administration at University of São Paulo (USP), professor and coordinator of the Professional Master's Degree in Projects at Foundation Institute of Administration (FIA). Then, a pilot was conducted to validate the research questions with selected health specialists and consisted in a presentation e-mail, an open interview, results transcription, analysis, and discussion of the results with the revision of the Delphi questionnaire. Table 1 presents information about the experts we interviewed during this study between July and Augusto/2021.

Table 1 - Delphi interviewees

| Interviewees | Gender | Education | Experience | Professional role | Professional background |
|---|---|---|---|---|---|
| 1 | Female | Post Doctor in Psychology | 11 years | Doctor of Medicine | Specialist in Health Innovation Risk Management |

| | | | | | |
|---|---|---|---|---|---|
| 2 | Male | System Information | 13 years | CEO at a Health Systems Company | Hospital Systems Integration Consulting and Development |
| 3 | Male | Doctor of Medicine | 5 years | Clinical solutions architect | Technology interoperability and automation |

Source: Author's elaboration

In the next section we present the main results of this Delphi.

## 4. Results

### 4.1 Health ecosystems in Brazil tendencies

There is a lot of trends in healthcare technologies. In view of the new technologies that will emerge, the interviews discussed about what they think that would be most likely to have growing space and consolidate in Brazilian hospitals by 2030. The firs trend pointed by the secondary data and by the interviews is the **Telemedicine and remote assistance**. Use of modern information and telecommunications technologies to provide information and medical care to patients and other healthcare professionals located in distant locations and to serve patients and providers in a virtual environment.

In this sense, the second trend was **Home Monitoring Diagnostic tools** and remote monitoring at home. Home diagnosis determines of the disease after the collection of information extracted from the patient's signs and symptoms remotely and the results of complementary exams performed (laboratory, radiological, etc.). The third trend was **Wearables Wearable Technologies**", which consist of technological devices that can be used by users as garments. This emergent technology, in special, is not new and struggled to move towards growth as they were unable to deal well with uncertainties. For example, uncertainty about new consumer habits and information security has undermined the smart glasses ecosystem (Klein et al., 2020; Canat Tech, 2021). Institutional and cultural barriers blocked any attempt to develop and grow this technology in the past.

In this sense, the Fourth, **Remote Clinical Surveys** use artificial intelligence to recruit patients online, make communication and scheduling more convenient, and bring testing sites closer to consumers. Fifth, **Connected Systems Health** entails information systems connected with social information systems. Sixth, value chain virtualization deals with automation of education, marketing and promotion and design processes, R&D lifecycle, clinical study and

project teams. Seventh, digitization of patient and provider support infrastructure. Eighth, **transporting information from physical to digital** and **ninth**, remote operations accelerating infrastructure redeployment for distributed and remote work. Below we present how se secondary data and the experts sees Health management systems tendencies.

### 4.2 Health management systems tendencies

Improvements in the hospital health system are needed for incorporating new technologies to the hospital's routines. Some trends in management considering the relationship with employees, customers, suppliers, government and competitors. The first trend refers to **Virtual Workforce Training and hiring** people with skills necessary for digital roles, and with expertise in virtual customer experiences.

The second refers to **Competitor Monitoring Alternative** which means that competitors gaining ground leading to advances in Benchmarking research and strategies to bar the entry of competitors in the market. Third, improved connection with the supply chain members and everyone who interacts in an aligned way to deliver a value proposition to the market. Fourth, **greater agility and resiliency of suppliers**, which means that hospitals must look for more effective methodologies for managing suppliers. Fifth, **greater sharing of information,** management of assets, interdependencies and complementarities between companies.

Sixth, **greater relationship between governmental and non-governmental companies** Generating greater exchange of information between them and mutual help focusing on new solutions for patients. Seventh, **proximity of the pharmaceutical industry with regulatory bodies** to establish a better understanding of both parties and thus improve deadlines and processes, speeding up the arrival of new medications and technologies. The experts also believe in greater **transparency and security for patients** generating more confidence in the solutions. Nineth, **social reprioritization of health determinants** by knowing that 80% of people's health comes from socioeconomic, environmental and behavioral conditions, emphasizing and prioritizing the real quality of life and not the disease. Tenth, d**ata that give clarity to the social determinants of health**. Namely, to use data to establish what should be prioritized at each moment in society. Eleventh, **flexibility of care** according to patient demand by building state-of-the-art modeling capabilities that can interconnect health and consumer data. Twelfth,

**Build Digital Capability Partnering** with digital companies to help develop a positive consumer experience. This includes redesign the highly virtual patient experience system that can address chronic care and more complicated conditions. Below, we present the main new technologies that should emerge and consolidate in Brazilian hospitals by 2030 in the view of the respondents.

## 5. Conclusion: The most promising trends in technology and management system according to experts

This study aimed to understand what new trends in health technologies will be present in Brazilian hospitals. The Delphi analysis is a support tool for decision making in organizations. More specifically, this tool helps us to understand the possibilities of the future so that we can better prepare ourselves for it. Many other trends were explored by the respondents.

### Changes in Technology

Some experts referred to 1) General Data Protection Law and it’s impacts on the hospital’s protocols. 2) advance in the understanding of psychosomatic illnesses and development of integrative methods (mind and body) to increase people's immune patterns. 3) By 2030, one expert commented that we will have advanced telemedicine. We will break down not only physical by also personal barriers to transform virtual medical meetings into virtual humanized medical meetings. Doctors will be worried about patient's physical, spiritual and emotional aspects. According to the expert: "The health of the future is the selling of a new life philosophy". 4) One expert told us about Machine learning for predictive analysis in the hospital environment. The use of this technology will help when calculating the discharge of beds, for example. 5) Improvement of telemedicine platforms, to integrate other actors such as supplementary health operators and other hospitals.

### Changes in Health system

1) By 2030, there will be greater integration between large and well-equipped hospitals located in metropolitan regions with small health centers in remote cities. The technology will allow quick service to regions far from large urban centers. There will be more investments in structures outside hospitals. Telemedicine structure with doctors supporting these small health centers will be a way to prevent critical problems from reaching hospitals urgently. Today this is still not possible because there is a lack of updated and integrated data between hospitals and

health posts. 2) Culture changes to demystify the doctor in the hospital environment. Doctors will be valued more for their doctoral degree. 3) Circular organization chart: There will be a change from hierarchical to circular organization charts within hospitals.

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