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# Linking Theoretical Perspectives to Analyze Health Information and Communication Technologies in Brazil

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Research-in-progress

## ABSTRACT

Over the course of the past thirty years, Brazil has developed health information systems (HIS). However, to date these HIS are fragmented and ongoing endeavors to integrate them have failed. Thus, this research-in-progress links two theoretical streams, namely: (a) HIS in developing countries; and (b) Information and Information Technology in Health, in order to establish a framework to assess health information and communication technologies (ICT) in Brazil. The proposed framework sees health ICT as a public policy aiming at developing technical artifacts – information systems, standards, processes and rules – to assist society in health issues. Besides, this framework sets up analytical dimensions for assessing this public policy, namely democratization, effectiveness, sustainability, and synergy. The proposed framework also enables the analysis of the trajectory of this public policy via the actors involved with it – politicians, bureaucrats, executives, and civil society –, who interact with each other within spaces influenced by rules and material elements such as information systems and previous standards.

**Keywords:** Health Information Systems; e-Health; Public Policy; Health Informatics; Brazil

## INTRODUCTION

Information and communication technologies (ICT) have been present in daily activities of most economic sectors such as commerce, entertainment, public services, etc. In line with this, in the health context, over the last twenty years, countries have bet on national strategies to incorporate ICT into health practices (Alvarez, 2002; Blumental, 2009; Blumental and Tavenner, 2010; Bowns et al., 1999; Brasil 2004; Gunter and Terry, 2006). However, notwithstanding efforts led by governments and private institutions, papers, pencils and stamps are still very much associated with daily routines within the health sector worldwide (Moraes and Gomez, 2007; Venkatesh et al., 2011).

This is also the case in Brazil, where the first health information systems (HIS) emerged in the 1970s (Moraes, 1994; Oliveira and Fleury, 1989) and after three decades much progress has been made in an effort to develop ICT for the benefit of health. In Brazil, HIS were developed by actors in both public and private sectors to meet the demands of health planning and management alike, leading the country to develop a national health informatics strategic plan (Brasil, 2004; Moraes, 1994; Moraes and Vasconcellos, 2005). However, recent attempts by the Ministry of Health (MoH) aiming to construct an Electronic Health Record (EHR) on a national level have failed (Amora and Menezes, 2009; Gaspari, 2011; Gaspari, 2010) and HIS produced in Brazil remain fragmented, limiting the use of information for the benefit of the Brazilian population (Moraes and Gomez, 2007).

While there are several systems and technologies being used in the Brazilian health sector and access to information is a right granted by the Brazilian Federal Constitution, most citizens are not allowed to access their health records and transmit them digitally. Consequently, questions have arisen about the barriers associated with the development of HIS in Brazil, as well as what is needed to disseminate the use of ICT in this area, such as: How has the process of ICT development in the health sector in Brazil taken place? Who are the winners and losers associated with this process in Brazil?

Obviously, this is not the first time those aforementioned questions have been posed, as there is extensive extant literature addressing the health informatics knowledge field. Thus, after a bibliographical survey of national and international scientific journals, two theoretical perspectives stand out by the efforts of researchers in understanding the dynamics of HIS in developing

countries, namely (a) European studies of HIS in developing countries (Avgerou, 2010; Braa et al., 2007; Braa and Hedberg, 2002; Braa et al., 2004; Heeks et al., 1999; Kimaro and Nhamposha, 2005, 2007; Kossi et al., 2009; Sheikh and Braa, 2011; Walsham and Sahay, 2006), and (b) Information and Information Technology in Health, developed under the Brazilian Sanitary Movement (Cavalcante and Vasconcellos, 2007; Moraes, 1994, 2002; Moraes and Gomez, 2007; Moraes and Vasconcellos, 2005; Moraes et al., 2009; Vasconcellos et al., 2002). Each research perspective has addressed, on its own, similar questions regarding HIS in the Global South since the 1980s. In that way, the HIS research field could benefit from the combination of both theoretical perspectives.

Thus, this research-in-progress articulates the two aforementioned theoretical perspectives in order to propose an integrated theoretical framework that allows the evaluation of the current stage of ICT usage in health practices in Brazil. On the one hand, the proposed framework defines the dimensions of analysis of health informatics in Brazil, and on the other hand establishes the contextual factors associated with the success/failure of HIS in Brazil. In this manner, the framework makes it possible to analyze simultaneously the outcomes of ICT development in health area and to build explanations for it based on historical and institutional factors. Besides, from this framework some propositions can be inferred to be further tested via empirical studies in order to better understand the health ICT realm in Brazil.

This work is organized in the following manner. After this introduction, the second and third sections review scientific literatures emerged from research on HIS in developing countries and on Information and Information Technology in Health, respectively. The fourth section articulates both theoretical perspectives and proposes an integrated framework for HIS analysis in Brazil. Finally, in the fifth section, concluding remarks are presented.

## **HEALTH INFORMATION SYSTEMS IN DEVELOPING COUNTRIES**

During the 1980s and 1990s, researchers generally based on European universities provided consulting services to governments and international organizations, supporting ICT projects in countries of the Global South. Beginning with these activities, scientific literature began to be circulated discussing how ICT contributes to social and economic development, along with factors associated with the success or failure of ICT endeavors in developing countries (Avgerou, 2010; Braa et al., 2007; Braa et al., 2004; Heeks et al., 1999; Walsham and Sahay, 2006).

In recent years, these studies have come to question whether ICT are really capable of promoting social and economic development (Avgerou, 2010; Walsham and Sahay, 2006), while demonstrating the importance of considering local contexts (Avgerou, 2010; Braa et al., 2004; Heeks et al., 1999), and featuring a wide range of theoretical and methodological perspectives (Avgerou, 2010; Walsham and Sahay, 2006)).

Specifically, in the health context, the Health Information Systems Project (HISP) has developed HIS for countries in the Southern Hemisphere for the last ten years (Braa et al., 2007; Braa and Hedberg, 2002; Braa et al., 2004; Kossi et al., 2009; Sahay et al., 2009; Sheikh and Braa, 2011). Other authors have also made their contributions to this knowledge field, such as Heeks, Mundy and Salazar (1999), Kimaro and Nhampossa (2005, 2007) to name just a few. This scientific literature has been grouped under the name of HIS in developing countries and will be seen below.

### **Qualifying Failure in Health Information Systems Implementation in Developing Countries**

In HIS in the developing countries scientific literature, studies have sought to identify the reasons why these systems succeed or fail (Braa et al., 2007; Braa et al., 2004; Heeks et al., 1999; Kimaro and Nhampossa, 2005, 2007). There are four categorized types of failure in the implementation of HIS, namely:

- (a) total failure: when the system is never implemented or a new system is implemented but immediately abandoned (Heeks et al., 1999, p. 2);
- (b) partial deployment of HIS or partial failure: when major goals are unattained or there are significant undesirable outcomes (Heeks et al., 1999, p. 2);
- (c) sustainability failure: when initiatives succeed initially, subsequently failing after a year or so (Braa et al., 2004; Heeks et al., 1999, p. 2);
- (d) replication failure: when an initiative succeeds in its pilot location but cannot be repeated elsewhere (Braa et al., 2004; Heeks et al., 1999, p. 2)

As revealed in the above studies, HIS can bring benefits to societies that use them if they are kept working, disseminated and updated (Braa et al., 2007; Heeks et al., 1999; Kimaro and Nhampossa, 2007). Thus, the scientific literature moves forward to identify the factors associated with the success/failure of HIS in developing countries, as presented below.

## **Key Success Factors for HIS Implementation in Developing Countries**

Studies reveal the importance of establishing networks of action that make HIS projects viable (Braa et al., 2007; Braa et al., 2004; Nguyen and Nyella, 2012; Sheikh and Braa, 2011). These networks of action are defined “as those intended to capture the dynamics of translating, aligning heterogeneous networks of routines, technology, and learning within politically-contested terrains of opposing projects and ideologies, in an effort to promote sustainable and replicable changes” (Braa et al., 2004, p. 342). The actors of networks of action include politicians, bureaucrats, representatives of international organizations, researchers, and technical artifacts, i.e. infrastructure, HIS and other technological resources (Braa et al., 2004).

This network of heterogeneous actors is mobilized to support HIS implementation, as well as promote their sustainability (Braa et al., 2004; Kimaro and Nhampossa, 2007), scalability (Braa et al., 2004), technical capabilities, and learning (Sheikh and Braa, 2011). In addition to this mobilization, it is also necessary to include marginal groups, as well as pay attention to deviations in relation to the original project objectives (Nguyen and Nyella, 2012). Therefore, strategies are needed to design flexible and participatory activities that bring together the different interests, with a view to mobilizing support for HIS (Braa et al., 2004)

Besides networks of action, technical capability is also singled out as a key success factor for HIS implementation in developing countries (Heeks et al., 1999; Kimaro and Nhampossa, 2007), being granted via knowledge transfer, sponsors commitment, as well as society involvement in the conception and implementation of these HIS (Kimaro and Nhampossa, 2007).

Another factor associated with the successful implementation of HIS in developing countries is the construction of flexible standards for information sharing. According to Braa et al. (2007), HIS are developed to attend a range of local and national interests, thereby leading to a complex environment. Thus, as presented in Figure 1, standards are necessary to integrate diverse existing HIS, as well as to allow the expansion of these systems to other places (Braa et al., 2007).

Therefore, a flexible standards strategy for information sharing is needed, whereby standards initially define a minimum data set that works as attractors (Braa et al., 2007). By this means, these attractors induce the creation of networks of actors to support the implementation of HIS. From this minimum set of information, new standards are developed in an incremental way, being

customized to attend local demands while national level information is kept integrated (Braa et al., 2007).

Regarding standards for information sharing, Smith et al. (2008) argue on the importance of different standpoints of information integration, namely: administrative, political, sociological, and epidemiological. Therefore, health information integration should consider not only management but also epidemiological aspects.

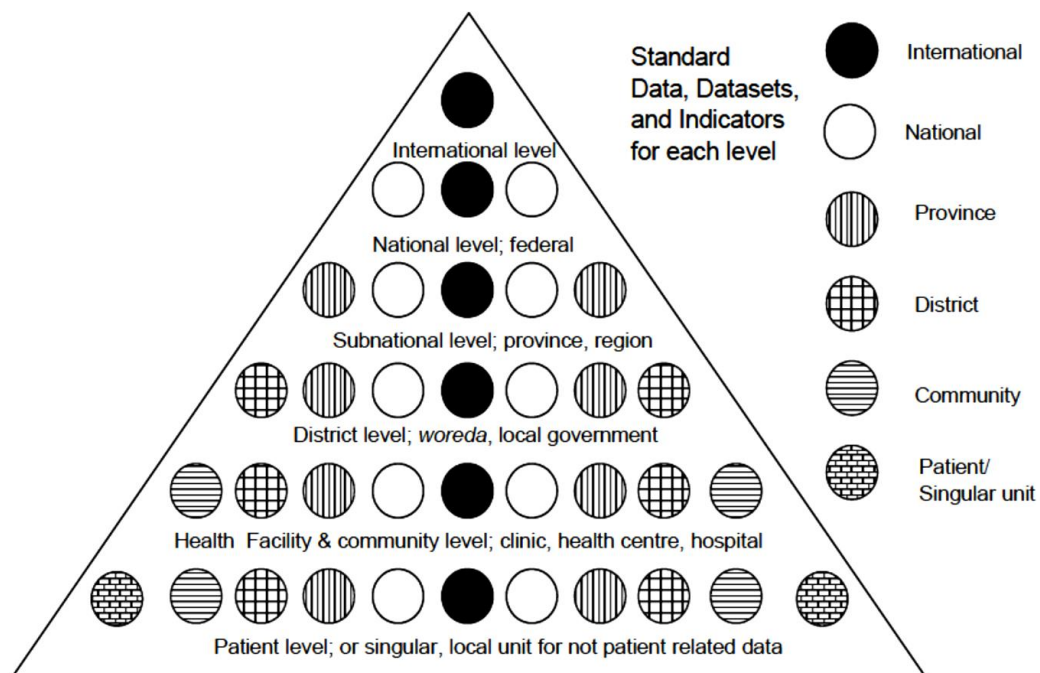


Figure 1 – Hierarchy of Standards used in South Africa. Source: Braa et al. (2007).

As presented, the literature on HIS in developing countries contributes to the understanding of such information systems, characterizing the results of HIS projects. In other words, success, failure, sustainability and scalability represent ways in which the results of HIS projects in developing countries can be measured, being present in the majority of works. Additionally, scientific literature on HIS in developing countries, based on concepts of networks of action and standards for information sharing, sets forth factors related to the success of HIS deployment in South Hemisphere countries.

In Brazil, in addition to the aforementioned studies, systematic research has been conducted on how HIS can contribute to the development of health practices, as presented below.

## **INFORMATION AND INFORMATION TECHNOLOGY IN HEALTH: THE BRAZILIAN SANITARY MOVEMENT**

The Brazilian Sanitary Movement arose in the 1970s when academics, workers and citizens launched a campaign for change in health practices, which at that time had social security-like characteristics and centralized management within the federal government. The social security system excluded minorities, such as the unemployed, informal workers and the elderly, while centralized management did not take into account the local and regional realities.

In this context, the Brazilian Sanitary Movement, challenging the prevailing model at that time, championed a political campaign for the universal right to health. This campaign was called the Brazilian Sanitary Reform, which culminated in the institution of the Unified Health System (SUS), the current base of the Brazilian health system.

Starting with the sanitarian line of thinking, many lines of research were developed, notably Information and Information Technology in Health (IITH). From this perspective, systematic studies about informational practices in health in Brazil were developed since the 1980s (Cavalcante and Vasconcellos, 2007; Moraes, 1994, 2002; Moraes and Gomez, 2007; Moraes and Vasconcellos, 2005; Moraes et al., 2009; Vasconcellos et al., 2002). Studies within IITH have pursued the democratization of social relations and the management and improvement of health (Moraes, 2002; Moraes and Gomez, 2007; Moraes and Vasconcellos, 2005). Therefore, as it can be seen in other studies linked to the Sanitary Movement, IITH has both a political and techno-scientific commitment.

IITH studies originated from the assumption that “health information should be employed in a manner that reinforces human rights, that contributes to the eradication of misery and social inequalities while subsidizing the decision-making process in the field of health, in order to promote effective care, quality respecting the uniqueness of each individual and the context of each population” (Moraes, 2002, p. 12).

From this assumption they sought to “reveal the genesis of the rationale that underpins the organization of Information in Health, running the risk of reducing it to its technical and operational aspects and thus diminishing its significance as part of the devices for the disciplinary power and the production of knowledge: the knowledge of a certain ‘watchful eye’ – the vigilant eye.” (Moraes, 2002, p. 33).



Taking into account the relations of power existing in health ICT, Moraes (1994) calls into question the neutrality of HIS. Thus, studies in IITH support that the production of health information is not neutral, as it constitutes part of a political struggle for health and for rights to citizenship.

Within this context, ICT can be used in a variety of ways, as Moraes (2002, p. 66) states: “Health Information Systems constitute the ‘technology of domination’, but paradoxically can also constitute ‘technologies of liberation’: technology of power, but also of transformation.” Therefore, it can be postulated that HIS create a strategic space in which diverse interests are disputed. In the next section, the main contributions of the literature on IITH linked to the sanitarian paradigm are presented.

### **HIS Fragmentation and Information Access Democratization**

Considering the need to disseminate health information in a democratic way, research based on the Brazilian Sanitary Movement detected the problem of HIS fragmentation (Moraes, 1994; Moraes and Gomez, 2007). In Brazil, there are various information systems to cater to specific demands, for example, birth control systems, mortality information systems, socioeconomic information systems, information systems for disease control - tuberculosis, AIDS and hepatitis, etc. (Brasil 2010). Therefore, the lack of integration between systems results in inconsistencies in information, affecting an adequate understanding of the Brazilian population’s health (Moraes, 1994; Moraes and Gomez, 2007).

The fragmentation of HIS has been evident since the beginning of the 1990s when the first studies about HIS in Brazil took place. According to Moraes (1994, p. 11), this fragmentation is not a coincidence, as it is the result of the fragmentation of the Brazilian State and of a set of diverse interests. Moreover, Moraes and Gomez (2007) sustain that this situation serves the interests of the state apparatus and of private businesses that wish to maintain the *status quo* of informational practices in health.

According to Moraes and Gomez (2007, p. 557), this practice is interesting for companies, “as it broadens the possibilities for ‘the sale of information systems solutions’, where a similar product can be purchased by various consumers (organs, departments, sectors), with little investment by companies in the process of customization.” Meanwhile, technical bodies of government, being the holders of knowledge about HIS, maintain their positions of power within the state apparatus.

It is therefore necessary to promote a political debate on the democratic dissemination of health information.

### **Information and Information Technology in Health Policy**

Research based on the sanitary approach proposes alternatives to overcome the fragmentation of HIS. For this, it starts from the perspective that information and information technology in health is a strategic space, where interests are in constant dispute. In the early 1990s, upon observing the necessity to construct an integrated approach to diverse sources of information, Moraes (1994) took the first steps toward the constitution of a National Policy on Health Information. Besides, the vision of public policy is reinforced by Vasconcellos et al. (2002). These authors argue that in the first few years after the turn of the twenty-first century, information technology was not part of the discussion of the National Health Policy, namely the core strategy of the Brazilian health system. As a result, they recoup the importance of a strategic discussion of information and IT in health (Vasconcellos et al., 2002)

Then, Moraes and Vasconcellos (2005) pursued a path for the formation of a national pact around the theme of information and IT in health, calling for a National Conference on Health Informatics and Communication (CNIIS). This conference would bring together all the interests of society, in order to enable broader use of health information for the benefit of the Brazilian population.

The perspective of public policy of information technology was reinforced by the approval of the National Policy on Information and Information Technology in Health (PNIIS) at the 12<sup>th</sup>. National Health Conference (Brasil, 2004). By being approved at the National Health Conference, the PNIIS acquired a legal framework status in the National Health Policy. Moreover, it charted a long-term strategic vision and defined attributes for the different entities of the federation and for civil society, aiming at the construction of an informational environment in the field of health.

However, in 2013, over eight years since the publication of the PNIIS, it can be observed that very little progress has been made. Of the 19 strategic action proposals, many of them never moved beyond the drawing board stage. Due to this, the Sanitary Movement began to search for new ways of constructing a space for discussion about health information.

## Information and Information Technology Interfield

In an effort to consolidate the information diversity, Moraes and Gomez (2007) transcend the vision of a policy for health information systems, proposing the construction of a political-epistemological interfield that encompasses the various HIS and the production of information in the field.

According to Moraes and Gomez (2007), “the information and information technology interfield was proposed in order to draw up a manifesto that considers actors, practices, procedures and knowledge that cross over as well as penetrate other ‘fields’, which have already constituted differentiated criteria of identity and value within common health references, as they challenge and cross zones of intersection that exist in the interstices of different fields, which today seem to describe the complex and segmented facets of science and action in health”.

As presented in Figure 2, the information and information technology interfield integrates HIS, from assistance to planning and management. This interfield is composed of the entirety of information related to health, namely administrative, financial, and assistance information, in both the domain of public health and of supplementary health. This information is widely utilized, from clinical practice – in professional/patient relations – to planning and management actions (Moraes and Gomez, 2007, p. 561). This defines a field that integrates health information, in which the topic of information is the center of action.

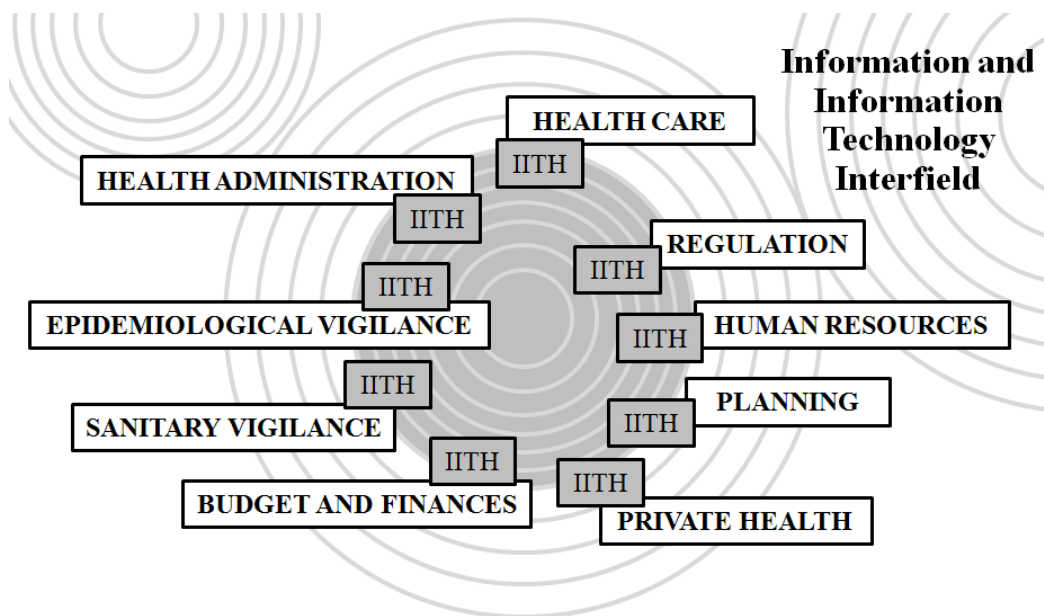
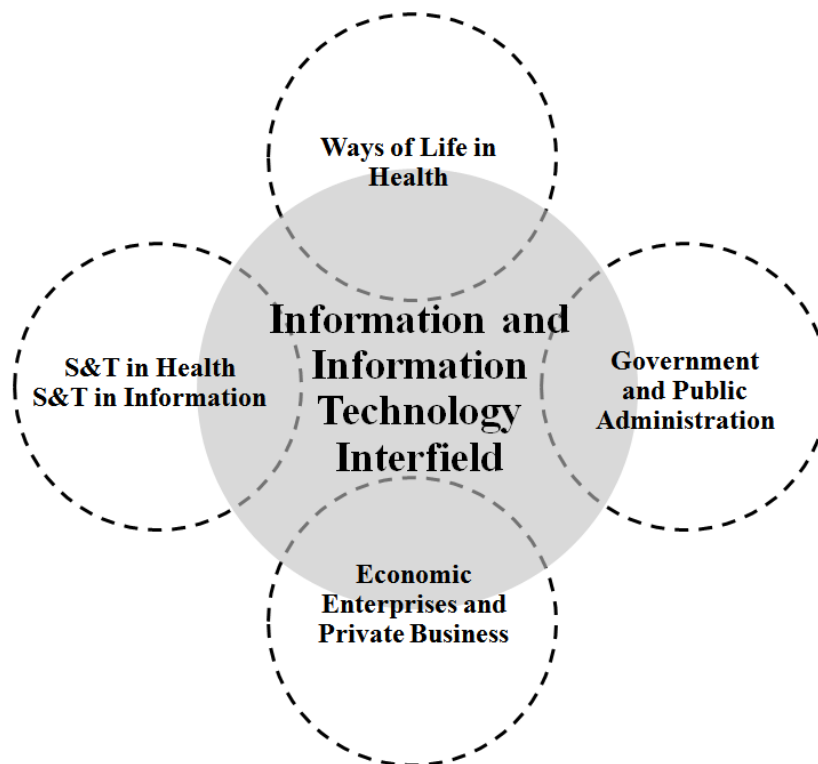


Figure 2 - Information and Information Technology Interfield. Source: Moraes and Gomez (2007, p. 561).

Based on the concept of the information and information technology interfield, Moraes and Gomez (2007) propose the spaces for discussion of the production of health information. As presented in the Figure 3, these areas involve public and private actors, comprising: (a) the ways of life in health, to which civil society is linked; (b) the government, covering instances of integrative health information; (c) economic undertakings, encompassing the producers of goods and services of information and communication technologies; and (d) science and technology, including education and research in health and ICT in health. The spaces would be related and, through them, informational praxis in health would be discussed (Moraes and Gomez, 2007, p. 563).

From the perspective of the discussion spaces, Moraes et al. (2009) analyze the utilization of information in the context of health councils, instances of social participation in the Brazilian health system, showing how information and information technology become mechanisms of power in the hands of managers in instances of popular participation. The authors, therefore, advocate the democratization of information, seeking to reduce the asymmetry between managers and the population. Thus, some studies based on these perspectives have examined workers' information (Facchini et al., 2005) and health education (Cavalcante and Vasconcellos, 2007).



**Figure 3 – Spaces Related to the Information and Information Technology in Health Interfield.**  
Source: Moraes and Gomez (2007).

The vision of the information and information technology interfield is important, as it relates to the sundry actors involved in the health information field – politicians, bureaucrats, executives and civil society – and associates them with the results of the discussion. Therefore, the interfield establishes parameters for analysis of the political struggle around information technology and its results, namely HIS, standards, processes, etc.

After reviewing both theoretical perspectives, the next section articulates them and proposes an integrated framework for health ICT public policy evaluation in Brazil.

## **AN INTEGRATED FRAMEWORK FOR HEALTH ICT PUBLIC POLICY EVALUATION**

This research-in-progress perceives health ICT as a public policy that aims at promoting the development of ICT in benefit of health practices. This position is supported by the tenets of the Brazilian Sanitary Movement (Moraes, 2002; Moraes and Gomez, 2007), being related not just with HIS but also with standards, infrastructure, working processes, and personnel directly involved in health information production. Thus, this health ICT public policy comprises: (a) analytical dimensions; and (b) factors associated with its success/failure, which are described in the section below.

### **Analytical Dimensions of Health ICT Public Policy**

Based on the above, one proposes four dimensions of analysis associated with health ICT policy, namely: democratization, effectiveness, sustainability and synergy, which are consolidated below in Table 1 and described in the following paragraphs.

Table 1 – Analytical Dimensions of Health ICT.

ANALYTICAL DIMENSIONS	THEORETICAL PERSPECTIVE	
	HIS in Developing Countries	Information and Information Technology in Health
<b>Democratization:</b> Information is a citizen's right and the State has the duty to disseminate health information.	-----	Information, democracy, and development (Moraes, 2002)
<b>Effectiveness:</b> Most of the HIS do not achieve the objectives initially planned.	Success/Failure (Heeks et al., 1999)	-----
<b>Sustainability:</b> The HIS have no sustainability, i.e., they are abandoned after a short period of use.	Sustainability (Braa et al., 2004; Kimaro and Nhampossa, 2007)	-----
<b>Synergy:</b> The HIS fragmentation limits the State in its response to society demands.	-----	Fragmentation (Moraes, 1994; Moraes and Gomez, 2007)

The *democratization* dimension is based on the contributions accrued from the Brazilian Sanitary Movement, which supports the engagement of society in discussions about health information (Moraes, 2002; Moraes and Gomez, 2007). Likewise, the proposal is that the construction of a political-epistemological interfield must occur in a participative way, involving government and civil society actors in the discussion about health information (Moraes and Gomez, 2007).

The *effectiveness* dimension aims at analyzing the outcomes of the planned endeavors. Braa et al. (2007) point out the pressing need to develop HIS effectively due to the structural needs observed in developing countries. Thus, this dimension is related to the results accrued from the application of scarce financial, infrastructural and other types of resources available in the health ICT public policy.

The *sustainability* dimension intends to analyze how the health ICT endeavors are supported over time. This dimension is based on the contributions accrued from the studies of HIS in developing countries (Braa et al., 2007; Kimaro and Nhampossa, 2007), stressing the very importance of these endeavors be sustainable, mainly after the sponsors have left the project. Thus, one must evaluate the preservation of the health ICT policy *vis-à-vis* changes in the political, technological, social, and economic environment.

The *synergy* dimension involves the compatibility of the health ICT policy with other public policies and institutional actors. Moraes and Gomez (2007) argue that the fragmentation of HIS jeopardizes the capacity the Brazilian government has to deal with health issues related to the population. Braa et al. (2007) discuss the heterogeneity of these systems and the importance of integrating them in order to enable their sustainability and expansion. Therefore, it is necessary to take into consideration the set of actions rather than merely conduct timely analyses.

### Factors Associated with the Health ICT Public Policy

Both research streams adopted in this work have been developed in order to identify factors associated with results accrued from health ICT actions. The extant literature about ICT in developing countries reveals contributions to identify the influence of local context, networks of action and standards for information sharing in the health ICT policy. On the other hand, the Brazilian Sanitary Movement sees health ICT as a space for political dispute, whereby diverse interests challenge each other, as it is necessary to de-mystify the technical aspect of information, seeing it as a social issue. Thus, these associated factors encompass the elements that influence the outcomes of health ICT, which are consolidated in Table 2 below, taking into consideration contributions from the two theoretical backgrounds used.

Table 2 – Factors Associated with the Health ICT Public Policy

ASSOCIATED FACTORS	THEORETICAL PERSPECTIVE	
	HIS in Developing Countries	Information and Information Technology in Health
<b>Local Context:</b> HIS implementation must consider the local reality of each country.	Local Context (Avgerou, 2010; Braa et al., 2004; Heeks et al., 1999)	-----
<b>Mobilization:</b> It is necessary to develop a network of actors, as well as to build a discussion space to support the HIS evolution.	Networks of Action (Braa et al., 2004; Sheikh and Braa, 2011)	Information and Information Technology Interfield (Moraes and Gomez, 2007)
<b>Standards for Information Sharing:</b> Information sharing standards are needed to allow information exchange among HIS.	Flexible Standards (Braa et al., 2007; Sahay et al., 2009; Smith et al., 2008)	Standards for Information Sharing (Vasconcellos et al., 2002)

The *local context* represents the set of factors associated with the results of the public policy (Avgerou, 2010; Braa et al., 2004; Heeks et al., 1999). However, no attempt is made here to ascribe the public policy results to a predefined local context. The intention is to understand how the sundry elements of this context interact, are related, and influence the outcomes of this public policy.

The *mobilization* of sundry actors involved with the health ICT policy shapes the dynamics of the results obtained. Consequently, both the political-epistemological interfield (Moraes and Gomez, 2007) and the network of actors (Braa et al., 2004) encompass actors that influence health ICT public policy. These actors are usually: a) politicians, who debate the law and the allocation of resources in public policies; b) bureaucrats, who manage the resources allocated, and c) civil society, comprising companies and users – health professionals and citizens –, which organize associations, syndicates, and social movements to influence the development of HIS. These actors mobilize interest groups, debate the HIS in discussion spaces and set up networks that influence the financial, infrastructural and human resource allocation, as well as the course of health ICT in the country.

Lastly, the development and deployment of *standards for information sharing* (Braa et al., 2007; Vasconcellos et al., 2002) is a critical success factor for HIS deployment, as well as for the improvement of health practices. These standards foster the sustainability and expansion of HIS (Braa et al. 2007), increasing the capacity of the Brazilian State to attend the population's health demands (Vasconcellos et al., 2002).

### **Integrated Framework for Health ICT Evaluation and Theoretical Propositions**

From the theoretical contributions set forth above, it is possible to develop an integrated framework for assessing health ICT, as presented in Figure 4.

The proposed framework can guide analysis of public policy on health ICT through analytical dimensions, namely: democratization of health information, effectiveness of HIS projects, sustainability of health ICT in the government agenda along the time, and synergy among the actions and projects conducted by multiple actors.

Such analytical dimensions are related to the results of public policy on health ICT, which is influenced by many factors inherent to the Brazilian local context of Brazil. The actors involved in the discussion and implementation of health information public policy, such as politicians, bureaucrats, executives, and civil society, define the way of such policy in instances of discussion.



Beyond these factors the public policy is also influenced by previous HIS, information technology infrastructure and technical standards, as well as by other public policies that have defined previous agreements and rules.

Thus, the framework, via assessment of its analytical dimensions and related factors, might be used *ex-ante facto* to assess the feasibility of a planned HIS public policy in Brazil. By the same token, the framework might also be applied *ex-post facto* to better understand the outcomes accrued from the implementation of a HIS public policy in Brazil.

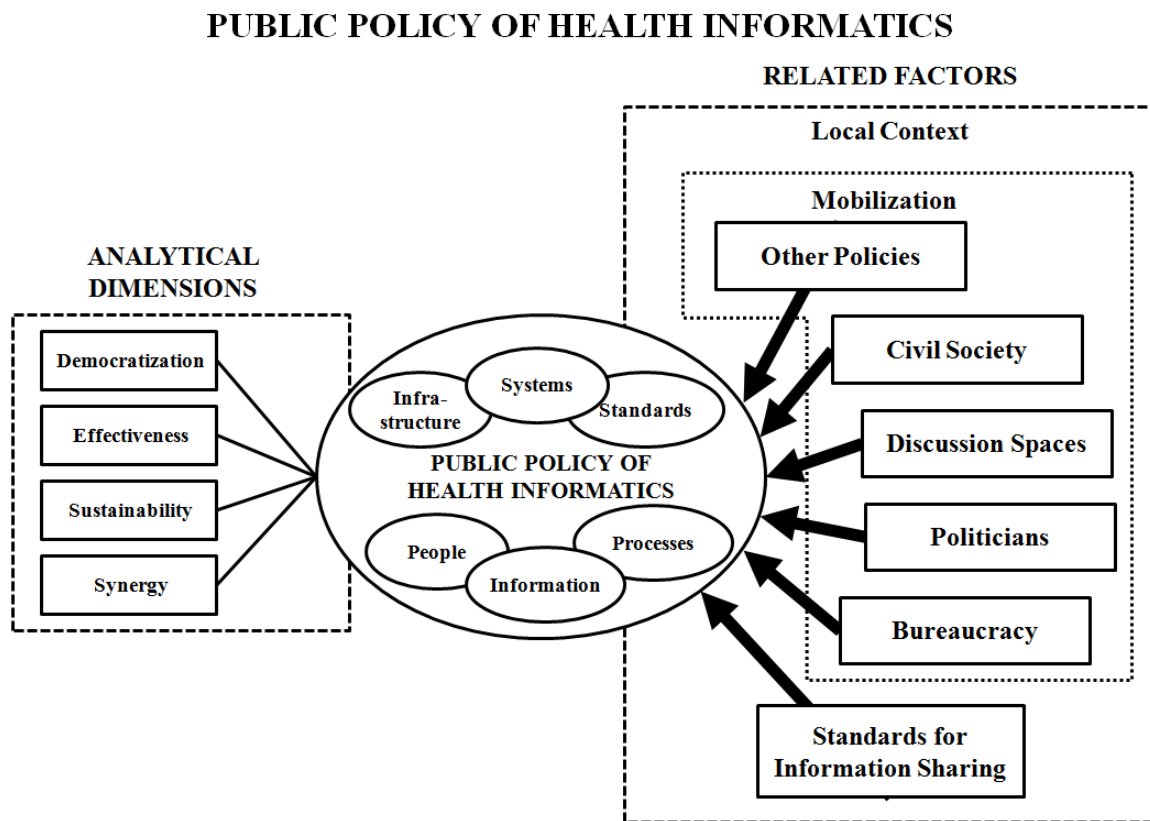


Figure 4 – Integrated Framework for Health ICT Evaluation. Source: authors.

Therefore, from the aforementioned dimensions of analysis and associated factors, some propositions might be posed, aiming to better understand the current scenario of health ICT in Brazil:

*Proposition 1: “The extant health information systems influence the outcomes of health ICT public policy in Brazil.”*

This proposition is supported by Braa et al. (2007), whose argument lies on the importance of standards for information sharing for sustainability and scalability of HIS. Moraes and Gomez (2007), in another way, also discuss how HIS fragmentation affects the development of health ICT. Therefore, the aforementioned proposition argues that standards for information sharing associated to HIS are elements that inscribe rules and influence the discussion of public policy on health ICT. In other words, the agreements inscribed in standards and HIS influence the decision making process in the public policy of health ICT.

Since the 1980s, many systems have been developed in Brazil, for example: National Health Card (Cartão SUS), Catalog of Health Procedures (SIGTAP), Information System for Notifiable Diseases (SINAN), National Register of Health Services (CNES), etc.. Such systems inscribe previous agreements, rules and standards that support, but at the same time constrain, the development of new HIS. Therefore, it is important to study how these information systems are influencing the development of health ICT public policy by showing their material effects on new HIS developments.

*Proposition 2: “The health ICT public policy outcomes depend on the Brazilian characteristics and contextual conditions.”*

Such proposition addresses the political and economic scenario of Brazil. For Avgerou (2010), HIS deployment should consider the local institutional context to achieve success. Moraes and Gomez (2007) argue that the fragmentation of the Brazilian state has led to the fragmentation of HIS. Thereby, this proposition considers previous agreements among the actors involved in decision-making processes related to health ICT public policy.

In Brazil, the public health sector supported by SUS and the private health sector based on assurances and private providers are competitors, shaping the way health ICT is developed in Brazil. Besides, the decentralized federative model of public health system in Brazil stimulates several spaces of negotiation between federal, regional and municipal governments to develop health public policies, including ICT. Therefore, in Brazil a peculiar institutional scenario influences the way sundry actors – politicians, bureaucrats, executives and civil society – discuss health ICT public policy.

*Proposition 3: “The participation of the government and civil society in discussion spaces about health ICT in Brazil has influenced the decisions about such public policy in the country.”*

Along the last twenty years, it has been created multiple instances of discussion regarding health ICT in Brazil. For example, Intergovernmental Commissions (CIB and CIT), Inter-Agency Health Information Network (RIPSA), Private Health Insurance Plans and Information Standardization Committee (COPISS) and Health Information and Information Technology Committee (CIINFO). As cited previously, networks of actors could be an important factor for HIS sustainability and scalability (Braa et al., 2004). In a seemingly way, the interfield of information and information technology is related to space of discussion in which there are multiple actors (Moraes and Gomez, 2007). Thus, it is proposed to probe such spaces of discussion in order to understand the decision making process of health ICT in Brazil and its results,

Then, testing those propositions might help to ascertain how the health informatics historical process, as well as material and institutional characteristics, have influenced the outcomes of health ICT public policy in Brazil.

## **FINAL REMARKS**

This research-in-progress reviews two scientific literatures – HIS in developing countries and Information and Information Technology in Health (IITH) – whose focus lies on the dynamics of health information systems in countries from the South Hemisphere considering the contextual complexity of such countries.

HIS in developing countries research context embodies a more operational focus, analyzing the success and the sustainability of HIS in the Global South. As such, they seek to identify the factors associated with the results accrued from the implementation of HIS projects in these countries, such as networks of action and standards for information sharing. Conversely, the literature on IITH raises questions about the democratization of HIS and political struggle associated with the dissemination of health information. Therefore, it problematizes the fragmentation of HIS and contextualizes the interfield of information and information technology in health.

It is important to point out that HIS in developing countries and IITH have some convergent approaches, namely standards for information sharing, engagement with social transformation, as well as the interfield of information and information technology and networks of actors. IITH can also help HIS in developing countries through the political problematization of information in

health. On the other hand, HIS in developing countries can contribute to IITH by showing that technical artifacts actively influence healthcare practices.

Then, the framework proposed in this work seeks to articulate and integrate two alternative theoretical perspectives in order to understand health information systems in the Brazilian scenario. First, the framework perceives health ICT processes in a holistic way, encompassing and positioning all information systems and technologies in a single context. In this manner, a more comprehensive analysis of health ICT implementation processes is made possible. This approach opens up a research track to analyze how different HIS relate with each other, as well as identify the actors associated with them.

Besides, the dimensions of analysis the health ICT policy, as depicted in the framework, allow to identify how this public policy is being developed, who is benefiting from it and how society is perceiving and discussing this public policy. Thus, different HIS and actions are evaluated using comparable criteria, such as democratization, effectiveness, sustainability and synergy.

Furthermore, the associated factors encompass a series of elements that influence health ICT public policy. Politicians, bureaucrats, economic groups, social movements, and research institutes can debate the health ICT policy and interact with the information systems via discussion spaces. Thus, the proposed framework allows to analyze how the institutional and material rules mediate the political struggle and generate results for the Brazilian society, namely the development of health information and communication technologies.

The literature review, although comprehensive, is not exhaustive, as the two theoretical approaches used in this article were chosen by the authors in a discretionary way, being that a limitation of the research. Yet, it is expected that the combination of these two theoretical perspectives can help to better understand the dynamics of HIS in Global South.

The proposed framework does not address directly some specific questions, such as privacy, and local technical capacity. However, such questions can be addressed in the spaces of discussion, where some specificities of the health ICT public policy might be addressed. In addition to that, the discussion of technical aspects related to the aforementioned public policy might also occur in a democratic way, involving all the public policy's stakeholders.

Lastly, the propositions elaborated in this research-in-progress stimulate further research seeking to analyze and assess health ICT in Brazil, as well as the factors associated with the success/failure

of this public policy implementation. It is then expected that the aforementioned framework might help researchers to answer the previous questions raised in this work regarding the current scenario of health ICT in Brazil.

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