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## Driving health technologies towards performance: a contextualisation within the hospital setting

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Irene Gabutti

Graduate School of Health Economics and Management (ALTEMS),  
Department of Management,  
Università Cattolica del Sacro Cuore,  
Largo Francesco Vito, 1  
00168, Rome, Italy  
Email: irene.gabutti@unicatt.it

**Abstract:** *Purpose:* Technology plays a crucial role in determining organisational performance and this is true also in hospitals. Nevertheless, there exists a lack of evidence on how well health technologies are expected to perform in *specific* hospitals, depending on their managerial characteristics. The aim of this work is to shed light on these dynamics and provide a clear picture of the expected effects of health technologies in hospitals. *Methodology:* Through multiple literature searches, a theoretical framework linking organisational contextual factors, technology implementation and organisational performance is provided and applied to hospitals. *Findings:* Contextual factors play a key role in determining performance of health technologies. Performance should be interpreted through a balanced array of dimensions and should be understood in a broader system-perspective. *Originality:* There emerges the need of a full awareness of the effects that hospital contextual factors exert on the use of health technologies and on their impact on performance.

**Keywords:** contextual factors; health technology; performance; hospital; conceptual framework.

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**Biographical notes:** Irene Gabutti is a Post-Doc Researcher and Adjunct Professor at the Faculty of Economics of the Catholic University in Rome. She teaches organisational theory, human resource management and health policy. Her research interests cover clinical pathways, continuity of care, and technological innovation in the healthcare sector.

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### 1 Purpose and background

It is known that technology is key in determining organisational performance across possibly any sector. Therefore, it is easy to understand why policy makers, managers and scholars nurture a great interest in studying its role within organisations (Orlikowski, 1992; Simon, 1990; Bhatt, 2001; Brusoni and Prencipe, 2001; Zammuto and O'Connor,

1992). However, it may still appear rather unclear how technology may affect it. This is not only because of the great variety of existing technologies, but also because of the complexity of the organisational environment in which they are implemented. It is always questionable whether a technology that is successful in a specific context can be as successful in another one (Szulanski, 2000). It is therefore important to have a clear understanding of which conceptual interactions may take place between organisational contextual items (contextual factors) and technologies, and how these may affect overall performance. Assessing organisational performance and understanding how we may affect it is usually the main objective of managerial effort. However, the more an organisation is large and complex, the more it is difficult to manage these dynamics.

Historically, studies have addressed the direct and 'standardised' relationship occurring between technologies and organisational performance (e.g., Woodward, 1958, 1965; Cumming, 1978; Edmonson et al., 2001 Greenhalgh et al., 2005). Some studies have detected a causal relationship of contextual factors on technology adoption and use. For example, organisational size and resources are held to promote the adoption of new technologies (Kimberly and Evanisko, 1981), as does senior management support (Yin, 1977). Moreover, the impact of contextual factors is not only referred to the mere adoption of technologies, but rather to their actual implementation. Many studies emphasise the need for organisations to adapt for a new technology to be used effectively (Barley, 1986; Attewell, 1992; Orlikowski, 1993, 2000; Szulanski, 2000). Scott too (1990) posits that organisations can adapt so to welcome a technology optimally. In other terms, organisations can extend, modify, and shape their own characteristics to provide an environment which is as fertile as possible for their own success.

A different view is the so called 'contingent approach' (Woodward, 1965; Perrow, 1965) which has traditionally evoked that technologies are independent causal agents, with them imposing specific structures and characteristics to organisations. Following the so called 'technological imperative model' (Orlikowsky, 1992), studies of technology (Aldrich, 1972; Blau et al., 1976; Perrow, 1967; Shepard, 1977; Woodward, 1958) and information technology (Carter, 1984; Davis and Taylor, 1986; Foster and Flynn, 1984; Hiltz and Johnson, 1990; Pfeffer and Leblebici, 1977; Siegel et al., 1986) examine the impact of technology on organisational dimensions such as structure, size, and centralisation/decentralisation, treating it as an independent influence on organisational properties and detecting unidirectional, causal influences over humans and organisations (Giddens, 1984).

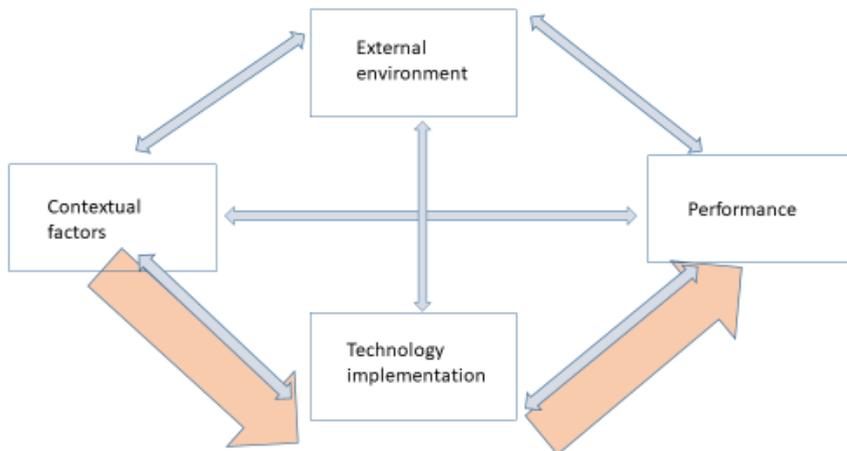
These 'anti-managerial' perspectives explain the effects of technologies on organisational contextual factors independently from managerial action (Donaldson, 1995). Among these, the evolutionary approach (Aldrich, 1999), the structuration one (Giddens, 1979) and the neo-institutional one (Powell and Di Maggio, 1991; Scott, 1990), all explain the effects of technologies on elements of organisations in ways that are not under the control of managers. Technologies exert an effect on routines (Nelson and Winter, 1982), on communities of practice (Brown and Duguid, 1991), on organisational competencies (Prahalad and Hamel, 1990), on organisational artefacts (Masino and Zamarian, 2000), on 'cells' (Miles et al., 1997). These are all elementary organisational units that constitute part of the global organisational scenario in which technologies are inserted (Barley, 1986).

However, although this approach provides fundamental guidance in understanding the 'power' of technologies, it tends to overlook the role of human action in developing, appropriating, and changing them (Orlikowski, 1992). It seems important, therefore,

to integrate different approaches that have emerged in time, building on a possibly mutual relationship between contextual factors and technology. For example, already in the sixties Harold Leavitt elaborated a ‘diamond’ suggesting that every organisational system is made up of four main components: people, tasks, structure, and technology. In his view, the fate of an organisation is determined by the interactions between these four components, given that any change in one component will produce effects on all the other three (Leavitt, 1972). This is one of the first attempts to explain the relationship between contextual factors (structure) and technology, positing a mutual effect. Leavitt’s work has been developed ever since the 70s (Wigand, 2007, Blumberg et al., 2019). For example, Orlikowsky (1992) suggested that technology is created and changed by human action, yet it is also used by humans to accomplish some action, enhancing what she called the ‘duality of technology’.

What seems to emerge, really, is a loop between contextual factors and technologies. The first may affect the second through managerial action. In turn, technology may exert an impact on contextual factors through anti-managerial dynamics. In this scenario, this study focuses on the relationships occurring between contextual factors, technology implementation and performance, with specific reference to the hospital setting. In Figure 1, the two thick arrows represent the relationships addressed in this work (within the broader set of relationships between dimensions in an organisational context).

**Figure 1** Representation of the relationships assessed between organisational dimensions (see online version for colours)



*Source:* Author’s elaboration

Building on the assumption that there exist mutual causal relationships between contextual factors and technology implementation, this work explores how the effects of the former on the latter may exert an impact on hospital performance. This effort is aimed at providing a contribution in covering the gap in what is known about why the same health technology can lead to very different results in different hospitals (Kidholm et al., 2015; Riddell Bamber, 2014). Hospitals are usually constrained by limited resources (Cicchetti, 2002). It is therefore fundamental to invest in technologies only in a condition of full awareness of their concrete contribution to the production of value. Efforts in Health Technology Assessment (Sampietro-Colom et al., 2015) are key in assisting

hospitals in adopting and dismissing technologies effectively. Nevertheless, technologies must also be ‘coherent’ with the organisational scenario in which they are introduced (Pralhad and Hamel, 1990; Achard, 1999; Achard et al., 2000). Moreover, assessing hospitals is of particular interest because of their high complexity due to, among other items, the peculiarity of their mission, the nature of the services they provide, their numerous stakeholders and their ethical constraints (Cicchetti, 2002). Although healthcare systems include a wider range of providers of care (e.g., primary care providers) and are frequently oriented to the provision of care across a continuum that is broader than the mere hospital contribution (Lega, 2007), it is important to focus on hospitals given their pivotal role in healthcare systems and their intrinsic complexity (Cicchetti, 2002).

This paper is organised as follows: this first section explores what is known about the relationships occurring between contextual factors, technologies, and performance, and has summarised evidence in a conceptual framework. After describing its methods, the paper contextualises the framework in the hospital setting, describing and discussing its concrete features. Finally, the relationships occurring between them are assessed and the limits, future developments and practice implications of the study are discussed.

## **2 Methodology**

The theoretical background of this work was built through a manual literature search conducted on Web of Science, integrated by a cross-references analysis. Both university textbooks and scientific papers published in top journals in the fields of general management and organisation theory/design were assessed, without time limits. Key words used included ‘contextual factor\*’, ‘organisation\* environment\*’, ‘organisation\* context\*’, ‘technology implantation’, ‘technology effectiveness’, ‘technology performance’. The abstracts of 74 international references were screened by the author, while 48 papers were fully analysed.

The contextualisation of the framework in the hospital sector, which is presented in the next section, has been carried out through specific tailored literature searches on Web of Science with temporal lag 2010–2020. A systematic literature review was not feasible in the absence of other researchers. A scoping review did not fully fit the objectives of this study given that the question addressed is rather specific (i.e., how can the framework assessed be applied to hospitals?) and not a general, broader investigation. For these reasons, a narrative review was carried out. This range was chosen to assess only relatively recent evidence, so to capture the present challenges of most hospitals worldwide. In particular, a search was carried out for each dimension of the framework (contextual factors, health technologies, hospital performance) through the following key words ((‘contextual factor’ or ‘organisation\* context\*’) AND (hospital or health\*)), (‘health technology\*’ AND (hospital or health\*)), (performance AND (hospital or health\*)). Overall, the abstracts of 169 records were screened in this phase and 43 were fully analysed. Papers referring to settings other than hospitals were excluded. A cross-reference analysis integrated this search. The characteristics of the papers selected referred to the three components of the theoretical framework assessed in this study, are summarised in Table 1.

**Table 1** Characteristics of the studies assessed within the literature review and related to the three components of the theoretical framework

<i>First Author</i>	<i>Year</i>	<i>Country</i>	<i>Study design</i>	<i>Component of theoretical framework</i>
Bazzoli	2000	USA	Quantitative	Contextual factors
Cai	2016	China	Quantitative	Hospital performance
Chen	2018	NA	Descriptive	Health technologies
Chen	2020	USA	Quantitative	Hospital performance
Cicchetti	2002	Italy	Descriptive	Hospital performance
Cicchetti	2003	NA	Descriptive	Health technologies
Coiera	1998	UK	Exploratory	Contextual factors
Estabrooks	2008	Canada	Case study	Contextual factors
Eun	2020	USA	Quantitative	Health technologies
Feibert	2019	Denmark/USA	Case study	Hospital performance
Gabutti	2018	Italy	Qualitative	Contextual factors
Gabutti	2020	Italy	Quantitative	Hospital performance
Goes	2011	NA	Descriptive	Contextual factors
Greenhalgh	2005	UK	Qualitative	Contextual factors
Hernandez	2013	NA	Qualitative	Contextual factors
Lawal	2019	NA	Qualitative	Hospital performance
Meijboom	2011	NA	Qualitative	Contextual factors
Morandi	2016	Italy	Descriptive	Contextual factors
Porter	2010	USA	Descriptive	Hospital performance
Provvidenza	2020	Canada	Qualitative	Hospital performance
Rathert	2012	NA	Qualitative	Contextual factors
Ribera	2016	Spain	Descriptive	Contextual factors
RobertSampietro-Colom	2009	UK	Qualitative	Contextual factors
Simou	2015	NA	Descriptive	Health technologies
Smith	2014	Greece	Qualitative	Hospital performance
Tai-Seale	2016	Ireland	Case study	Contextual factors
Vesty	2014	USA	Quantitative	Contextual factors
WHO	2017	UK	Case study	Hospital performance
	2014	NA	Descriptive	Health technologies

All selected papers were reviewed, and their data was systematised by coding emerging conceptual themes manually.

### 3 Findings

An attempt to apply a theoretical framework to a specific setting must translate the dimensions under analysis into ‘tangible items’ which can be studied, measured, and managed. To do so, the concrete components and features of hospital contextual factors, health technologies and hospital performance are identified.

#### 3.1 Hospital contextual factors

Several studies have explored hospital contextual factors. Some scholars have distinguished ‘organisational’ characteristics from ‘contextual’ ones, with the first including rather hard dimensions such as complexity, innovativeness, size, control, centralisation and the second more soft ones such as culture, leadership, climate (Robert et al., 2009; Estabrooks et al., 2008). In this vein, Greenhalgh et al. (2005) classify organisational characteristics as ‘inner context’ which can be thought of as the vehicle through which any innovation must pass before it is diffused and adopted in an organisation and contextual ones as a soft medium of culture and ways of working. Concretely, though, all these dimensions can be thought of as specific items that can be translated into a set of (hard or soft) tools that an organisation has at its disposal to affect the way ‘things happen’.

Within a hospital, for example, these items may have to do with the type of organisational chart (tall vs. flat, vertical vs. horizontal, etc.) (Rathert et al., 2012) or with the number and type of responsibility centers and their role within the organisation (departments, clinical wards, operating blocks, clinical pathways, and other horizontal settings, etc.) (Ribera et al., 2016).

Moreover, the set of managerial accounting (MA) tools the hospitals adopts – and how it implements them – may exert a crucial role in the dynamics of the organisation. For example, the types of MA tools adopted (e.g., management by objectives reports) as well as their contents (mainly economic, both economic and concerning efficiency of processes, patient satisfaction, organisational innovation) may affect the organisation’s functioning deeply (Hernandez et al., 2013). As mentioned, not only are the tools crucial *per se*, but so are the *ways* in which they are used (Smith and Loonam, 2016). For example, the extent to which these tools are rooted in the organisation through cascading may have a determinant effect on the hospital’s success. Whether they are applied collectively or individually, only to top managers or also to lower managerial lines, only to some organisational units or to all of them in an overall integrated manner, may make a substantial difference. Concretely, this kind of tool can determine the degree of responsibility and autonomy of different organisational units. Hospitals are typically organised into (traditional) vertical departments or clinical directorates and (more and more popular) horizontal or transversal units (e.g., clinical pathways) that follow patients along a continuum of care. MA tools have the power to affect how responsibility may be shared among such units and – in turn – how work is carried out throughout the whole hospital.

Another family of tools that can exert a fundamental role are human resource management (HRM) tools. These include a vast range of tools used to cover all the phases of HRM: hiring, allocating, training, evaluating, incentivising people. A fundamental topic here is the capability of an organisation to clearly design roles and provide people with the right competencies needed to cover them (Gabutti et al., 2018).

A major problem within complex organisations such as hospitals has to do with the risk of incurring into overlapping responsibilities or situations in which it is not clear who should be doing what (Goes, 2011). In this vein, a clear, exhaustive, and broadly approved set of roles is crucial. Moreover, the organisation's capability of assessing people's concrete competencies (and of monitoring them in time) is fundamental in running activities smoothly (Morandi, 2016). Hence, organisations that have implemented managerial approaches based not only on the evaluation of performance but also of competencies, may be able to foster competitive advantage.

The set of its Information Communication Technology (ICT) tools constitutes another major dimension that defines a hospital's contextual identity. Clearly, enhancing safe and effective communication flows within a hospital is fundamental (Tai-Seale et al., 2014). This has to do with the transmission of clinical and administrative data, but also with information concerning other facets of hospital activity such as efficiency in processes, patient, and staff satisfaction, etc. Delays in information access, incomplete information or irrelevant and redundant information may hinder a smooth functioning of the organisation (Coiera and Tombs, 1998). Another crucial topic has to do with the level of integration of communication systems. Hospitals are necessarily part of a network of actors, whether they cover the role of hub or of spoke (or both) within this network (Bazzoli et al., 2000). The challenge of creating fluid flows of communication not only within but also across settings and organisations is a major topic in the healthcare scenario worldwide (Meijboom et al., 2011).

### *3.2 Health technologies*

Although hospitals depend on numerous technologies of different sorts, the possibly most expensive and decisive set of technologies in this sector are health technologies. These imply the application of organised knowledge and skills in the form of medicines, medical devices, vaccines, procedures, and systems developed to solve a health problem and improve quality of life (WHO, 2014). It is easy to see that the meaning of health technology is broad. Not only does it encompass large, expensive, and highly sophisticated surgical or diagnostic equipment, but also other technologies such as medicines, (implantable or non-implantable) medical devices and clinical procedures (Sampietro-Colom et al., 2015).

Although 'traditional' health technologies are paramount in providing health services within hospitals, several new technologies are gaining great importance. Medical technology has evolved into smaller portable devices, for instance smartphones, touchscreens, tablets, laptops supported by innovations such as electronic health records, clinical decision support programs and telemedicine. Artificial intelligence is held to play a crucial role in the next decade (Chen et al., 2018). Artificial intelligence is a program that enables computers to sense, reason, act and adapt. It deals with large datasets, solves problems, and provides more efficient operations, with the effect of improving outcomes and reducing costs. Not only does it help to detect diseases and deliver health service in optimal ways, but it also has the potential of guiding healthcare organisations in the best possible allocation of resources (Eun et al., 2020).

All categories of health technologies require massive investments that are binding for long periods of time (Cicchetti, 2003). Hence, decisions on the adoption of health technologies should take into account economic, technical, clinical, organisational and

strategic implications (Cicchetti, 2003). The ‘value’ a technology is capable of producing is inevitably connected to all these dimensions.

### *3.3 Hospital performance*

The task of defining hospital performance is particularly arduous given the wide range of dimensions that are at stake. Moreover, the many stakeholders permanently involved in hospital activities (patients, managers, doctors, policy makers, etc.), make it difficult to unanimously determine which facets of performance should be held crucial to assess a hospital and with what priority (Simou et al., 2014).

It is therefore important to adopt and implement managerial and evaluation tools that allow to ‘balance’ the different facets of hospital performance. Although the existing tools are many in number and variety (Cicchetti, 2002), a tool that adequately adopts this multi-faceted principle is the Balanced Scorecard (BSC) (Vesty and Brooks, 2017). This is done by calibrating the different dimensions of performance at stake when carrying out the activities of the organisation, balancing them jointly. Traditionally, the domains of performance assessed through BSCs in the traditional private industry include the financial one, processes, customer satisfaction, learning and growth.

Although it is at times frustrating to think of hospitals as entities oriented towards financial performance, the importance of this domain is straightforward. Not only is this true for private hospitals, but also for public ones. Although a hospital’s mission is to produce health and not to make profits, its financial sustainability is a key aspect of its performance. Some national health services have imposed balance as a rule for the hospitals operating on their behalf (Gabutti, 2020).

Assessing processes is also of the utmost importance in at least two ways. In the first place in connection to processes in a strict sense. Their number within a hospital’s daily activity is uncountable (Feibert et al., 2019). Processes are activated in carrying out a surgical activity, in administering a drug, in using a technology, in fostering a communication flow. The swift, efficient, and safe implementation of processes is key for overall hospital performance. Moreover, the term process can be intended in a broader sense. By process, one can intend clinical pathways (Lawal et al., 2019), i.e., the sequence of steps a patient must face during his/her continuum of care. Indicators able to measure the weight of deviations from procedures (or from clinical pathways) as well as their time of implementation, give crucial information on the ability of the hospital of performing activities in an efficient way.

Customers’ (whether internal staff or external patients) satisfaction is a priority for hospitals. This holds true in reference to patients, who have the choice of whether to keep using the services of that hospital or not (Chen et al., 2020), as well as to staff, which has the power to decide where to work (Cai et al., 2016).

Finally, in the learning and growth perspective it is paramount to make sure that hospitals feed their set of competencies and of knowledge (Provvidenza et al., 2020). Indicators able to capture the quantity and quality of training activities or the scientific contribution to the academic society are examples of dimensions that belong to this area.

It is frequent that the array of performance domains that hospitals must monitor and assess are more numerous than the typical ones just described. For example, a hospital may decide to include a strictly clinical domain, or a domain connected to its impact on the surrounding area. Other possible performance domains include patient accessibility, safety, efficiency, equity, appropriateness, patient-centeredness (Cicchetti, 2002).

Furthermore, depending on the characteristics of the hospital, each domain can be given a more or less relevant weight compared to the others (this is indeed why it is a ‘balanced’ approach). Generally, the number of indicators to track and assess in a hospital is possibly countless. It is clear, therefore, that defining hospital performance must take into consideration a range of indicators and dimensions, each of which should be balanced within the general assessment of performance.

Alongside the challenges of measuring performance, hospitals face a further and extremely arduous one. As a matter of fact, this has to do with the final goal of a hospital, which is not being efficient, patient-centered or innovative, but rather that of ‘producing healthy people’. This, in Porter’s terminology (Porter, 2010), is what is called producing value. Value is defined as the patient health outcomes achieved per dollar spent and “encompasses many of the other goals already embraced in healthcare, such as quality, safety, patient-centeredness, cost containment, and integrates them” (Porter, 2010).

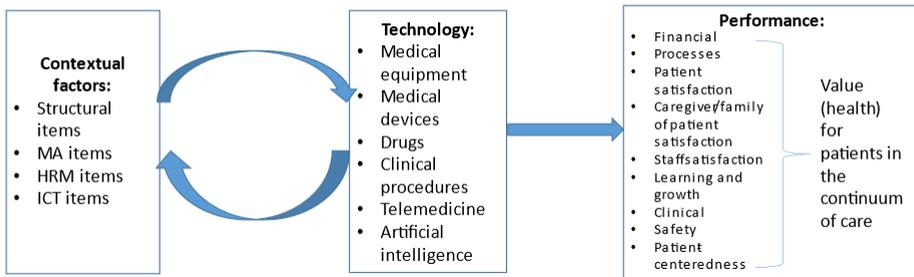
In this way, there emerges an incredible misalignment between what is measured concretely by hospitals and what is truly relevant to patients. The bias is probably due to the tendency of measuring what is easy to measure at the expense of the measurement of ‘health’. If value is defined as patient health outcomes achieved relative to the costs of care (Porter, 2010), it is crucial to measure both health outcomes and costs not only in the short but also in the long run. In other terms, it is not possible to identify a single outcome that captures the results of care for a specific medical condition. On the contrary, one should assess a set of multidimensional outcomes that jointly constitute patient benefit, including survival, functional status, and sustainability of recovery. Cost, in the same vein, refers to the total costs involved in the full cycle of care for the medical condition and include the full array of resources involved in caring for the patient, including inpatient, outpatient, and rehabilitative care, along with all associated drugs, devices, services, and ancillary equipment (Porter, 2010).

Accountability for value across the continuum of care should hence be shared among different professionals and providers who are involved in the treatment of patients at different stages of their clinical pathways. The problem arises insofar as providers (e.g., hospitals) tend to measure only the interventions they provide directly. This, in turn, produces incomplete and fragmented evaluations of the system’s performance, usually failing to track outcomes over time such as sustainable recovery, need for ongoing interventions, or occurrences of treatment-induced illnesses. The use of the various types of indicators at the hospital level, therefore, is surely fundamental but does not coincide with the measurement of outcomes. They should all be measured and monitored within a clear picture of how they affect real value in the (long-term) perspective of patients.

### *3.4 Adapting the conceptual framework to hospitals*

Having a clear vision of the characteristics of the various dimensions at stake within the hospital context allows to better explain the relationship occurring between organisational factors, use of technology and performance. The framework discussed above is further developed in Figure 2 by exploring the concrete items to be managed and linked within hospitals. Having a clear vision of the items to link across the dimensions allows to better explain their interactions. Although these are potentially infinite, it may be useful to describe some of the most common.

**Figure 2** Representation of the relationships occurring between contextual factors, technology implementation and organisational performance applied to the hospital context (see online version for colours)



Source: Author's elaboration

As mentioned, vast literature in healthcare management has documented the ability of technology to affect hospital performance (Sharma et al., 2016; Woiceshyn et al., 2017; Al Hammadi and Hussain, 2019). For example, we can assume that medical equipment, medical devices, and drugs are likely to affect dimensions such as patient safety, financial outcomes, and processes (Lin et al., 2001). A diagnostic or surgical tool could increase the number of procedures performed and reduce non-value-adding hospitalisation (financial outcome), as well as improve safety for both staff and patients and the overall 'through-put' time, affecting processes (Lin et al., 2001; Paxton et al., 2013).

Similarly, clinical procedures may exert an impact on staff's ways of performing clinical activities with effects on both staff's and patients' satisfaction and safety (Marley et al., 2004). In turn, vast literature ever since the 1980s testifies that staff satisfaction is a key predictor of overall quality of care, being strictly connected to patients' satisfaction too (e.g., Weisman and Nathanson, 1985).

Telemedicine can affect financial performance, for example by assisting patients in less expensive settings (Thaker et al., 2013), patients' safety and overall satisfaction, for example by reducing waiting lists and avoiding unnecessary visits to the hospital (Weiner and Fink, 2017). Artificial intelligence is key in driving activities towards safety (Yeung et al., 2018) and in providing learning and growth opportunities to organisations (Neill, 2013).

Nevertheless, contextual factors may affect the ability of technology to influence performance, and this is frequently overlooked by scholars and by hospital management. Structural items are likely to be determinant in the use of technologies in many ways. If we think of medical equipment, it is easy to see that different organisational configurations are likely to imply different ways of assigning time slots and use of this equipment (Cardoen et al., 2010). For example, a traditional rigid, vertical organisational chart based on departments, each made up of clinical wards, usually implies that each department disposes of its own operating rooms (Gabutti and Cicchetti, 2017). Instead, horizontal charts based on more recent patient pooling approaches are likely to imply shared operating theatres (Cardoen et al., 2010). The philosophy behind the use of surgical equipment will change. In the first case we have an individualistic (of the department) management of it, in the second, a more centralised one, possibly driven by dedicated professional figures. Several studies suggest that this second approach is more likely to increase time slot saturation and to reduce overall waste, affecting efficiency

positively (Villa et al., 2009). Structural items are also likely to affect, for example, clinical procedures. In a context characterised by multi-pathological patients who are more and more in need of structured clinical pathways, a horizontal organisational chart that formalises such pathways is possibly more adequate to support the implementation of clinical procedures (Ribera et al., 2016).

MA tools exert an effect on the use of health technologies in different ways too. For example, depending on their capillarity and specific contents, professionals may have higher incentives to use them efficiently. If we think of a hospital that ties, for example, part of a department's performance (and budget) to indicators measuring 'through-put hospitalisation time' of patients hospitalised within the department, the latter may be encouraged to better plan the assignment of time slots for the use of equipment. In a similar vein, if the performance is measured through MA tools in terms of cost reduction, the department may have an incentive to better manage drug consumption and avoid wastes.

The ways through which HRM items affect technology implementation and, in turn, performance are numerous. For example, training initiatives should be tailored on the concrete results expected by technology implementation. Moreover, HRM tools can assign responsibilities to professionals. Many hospitals face sub-optimal performance due to professional covering tasks with which they feel uncomfortable. As an example, many physicians tend to complain about having to perform activities that are neither coherent with their expectations, neither completely understood (Magsamen-Conrad and Checton, 2014).

Finally, the ICT asset of hospitals is key in driving the use of practically any health technology. It is crucial to have a system able to provide swift and accurate information on patients' records so to implement clinical procedures effectively, but also to provide telemedicine consultations that require a clear picture of the patient's health status and history (Fico et al., 2016). Moreover, ICT tools must be able to track and keep record of data such as, for example, drug and medical device consumption so to foster units' accountability. ICT tools are key in gathering data from potentially any unit of the hospital and feed articulated datasets that are core in the development of artificial intelligence exploitation.

## **4 Discussion**

The framework elaborated in this work provides guiding principles to design future research and to address hospitals towards better performance. There emerges the need to be in possession of a full awareness of the effects that hospital contextual factors are likely to exert on the use of health technologies and on their impact on performance. For example, an organisational asset that privileges horizontal transversal responsibility units designed around patients' cycle of care, may influence how/how much the surgical equipment in operating rooms is used. Therefore, when deciding to introduce specific equipment, managers should be aware of how it fits with the current organisational chart. Whether this can assure a full saturation of its use, and whether HRM tools are capable of bringing up the needed multi-disciplinary teams with the right (clinical and managerial) competencies, should be considered when taking a decision. In general, technology investment decisions should be taken after having analysed how each of the existing

hospital's contextual factors is likely to affect its use and possibly enable or hinder its full performance.

Measuring performance, in turn, should take into account at least two issues. The first is the need to 'balance' different performance domains in a fair and consistent way. None of the numerous acceptations of hospital performance should be overlooked, given that they jointly produce performance. The second is to be aware of the fact that most indicators are 'proxies' of the 'true' acceptance of performance, i.e., health (value). Therefore, they must be interpreted with caution and must be linked to real outcomes. A hospital alone is not able to determine the health of patients. It can of course affect it, so assessing hospital performance should really consist in determining how effective it is in co-producing health. This means that the impact of the use of technology on performance should gradually be interpreted in a broader sense. Whether we can feel satisfied with a technology's performance should depend less and less on setting-specific indicators, but rather be interpreted in reason of the value it produces within a clinical pathway. This way of facing investment decisions presents a higher degree of complexity but also implies a comprehensive point of view. The transition from a hospital-centric to a patient-centric approach must be gradual and 'traditional' performance evaluation is still fundamental. Yet, introducing new conceptual schemes that foster this new approach, is probably the first step towards investing in technologies that meet the overall needs of patients.

## **5 Conclusions**

It is worth mentioning some limits of this work. Contextual factors (and their effects) are examined independently from the impact of the external environment. Although the environment is a fundamental aspect to consider in understanding the relationships addressed, adopting an internal (to the organisation) point of view is still key in decoding and managing organisational variables that are indeed under the control of hospital management.

Moreover, the labels used to describe contextual factors are some of the possible ones, being contextual factors possibly infinite and attributable to further families. Yet, any framework must inevitably simplify the real world and the contextual factors assessed here are all debated in the scientific community.

In the same vein, the descriptions of contextual factors are possibly not exhaustive. For example, in reference to MA tools, BSCs are only one out of many possible tools that can support effective hospital management. Nevertheless, the objective of this work is not to provide an exhaustive description of each dimension of the framework, but rather to push scientific reasoning towards a broader and patient-centric approach, overcoming the still unsolved issue of operating in fragmented healthcare systems and organisations, in which decisions are all too often taken with limited consideration of their overall effects.

In general, this framework is of support to scholars in adapting their research on technology uptake towards more context- and patient-centric perspectives so to support, in turn, hospital management in adopting and dismissing health technologies with a clear awareness of their long-term effects. The importance of tying technology uptake decisions to contextual factors is frequently overlooked, yet the dynamics through which the latter may impede (or sustain) their positive effects are numerous. Moreover, the mere concept of 'effect' or performance of technologies is possibly misleading in a system-

wide perspective. Although measuring, monitoring, and driving hospital performance as we usually intend it is fundamental, this should not ignore its overall contribution in providing health within the community. In other terms, although hospitals should indeed invest in monitoring their setting-specific indicators, these should be integrated and interpreted in a broader perspective. The responsibility may not necessarily fall on hospitals only (i.e., policy makers and national/local institutions may have to drive such cultural switch), but it is indeed hospitals' responsibility to prepare their managerial approach and informational asset, so to be coherent with the main changes that health systems are called to implement.

Future theoretical and empirical research should focus on some of the numerous dynamics suggested in this paper with a more specific approach.

### **Competing interests**

The author of this paper certifies that she has NO affiliations with or involvement in any organisation or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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### **Author contributions**

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