Method to Understand Value Generation in Healthcare Built Environments based on the Means-End Chain Approach

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Keywords: Value Generation; Healthcare Built Environment; Healthcare Services; Hierarchical Value Map; Means-End Chain; Laddering Technique

Abstract

Background: Existing literature highlights the crucial role of Healthcare Built Environments (HBE) in generating value and shaping service experiences. HBE must fulfil their intended purpose during the operational phase of construction projects to generate value. Additionally,

many design requirements for facilities are shaped by the needs of clinical and support services, as well as those of users. Therefore, understanding value generation requires considering the dynamic interdependence between physical space and service needs. However, previous studies have not thoroughly explored these relationships, leaving a critical research gap.

Objective: It aims to propose a method to understand value generation in HBE by examining the relationships between built environment attributes and healthcare service delivery, from the perspectives of multiple user groups.

Method: Design Science Research was the methodological approach adopted in this investigation. Two empirical studies were undertaken in different hospitals.

Results: The primary output is the i3 method, a novel approach for understanding value generation in HBE. It integrates the laddering technique, which is based on the means-end chain conceptual model, with additional sources of data, such as design documents, interviews with stakeholders, and direct observations of the HBE.

Conclusions: Findings highlight the importance of analysing the interactions between the HBE and services, revealing opportunities to enhance value generation. The hierarchical value maps generated through the i3 method offer a structured approach to support design decision-making. The i3 method helps identify overlooked constructs and relationships, such as the need for HBE adaptability to address service changes or respond to unforeseen service demands.

Implications for Practice

- Provides a structured approach to understand value generation in Healthcare Built Environments;
- Supports communication by mapping and visualising key constructs and their interconnections in value generation, which can be used to support design decision-making;
- Supports the alignment between the organisation strategic goals and the expectations of different user groups, helping ensure that institutional values are reflected in tangible HBE attributes;
- The i3 Method can be used to assess healthcare facilities, in order to highlight how they contribute to value generation.

INTRODUCTION

Healthcare Built Environments (HBE) are physical spaces where healthcare services are delivered, such as patient rooms, circulation spaces, rooms for diagnostics and nursing stations (Tillmann et al., 2010). These include the building itself and furnishings, furniture and other equipment and their characteristics, e.g. aesthetics (Hollnagel, 2014). HBE play a key role in supporting the healing process (Ulrich et al., 2010) and facilitating the efficient delivery of care (Tzortzopoulos et al., 2009; Ransolin et al., 2022). Designing HBE requires careful consideration of a wide range of needs and priorities from various stakeholders (Jallow et al., 2014).

Different stakeholder groups have distinct design requirements (Bitner, 1992; Hamed et al., 2016; Kim et al., 2013). Service providers focus on service performance and environmental needs (Rechel et al., 2009; Liddicoat, 2020), while considering factors like staff satisfaction, productivity, and motivation (Francis, 2002; Helkkula, 2011). By contrast, for patients and families, safety, security, privacy, and comfort are usually the most important needs (Huisman et al., 2012). This diversity of needs makes the design of HBE complex, requiring careful prioritisation of requirements (Jallow et al., 2014; Hicks et al., 2015).

Understanding how the HBE generates value is essential, as it has important implications for clinical outcomes, users' quality of life, as well as for the economic performance of healthcare providers (Keeney, 1996; Francis, 2002).

According to the built environment literature, "value" is created when a facility meets users' needs and effectively serves its intended functions (Koskela, 2000; Tillmann & Miron, 2020). In the HBE context, "value generation" is closely linked to the healthcare service experience (Teixeira et al., 2012; Lee, 2017), which is shaped by the interaction between service providers and end-users as they navigate the built environment. For example, the design of a hospital

patient room can simultaneously enhance patient's comfort and improve service provider's productivity (Bitner, 1992).

This research adopts a multidimensional approach to value generation (Sánchez-Fernández & Iniesta-Bonillo, 2007; Zeithaml et al., 2020), with a focus on the interplay between healthcare service delivery and the built environment. This multidimensional approach accounts for the diverse needs of users and necessitates a careful balancing of competing priorities (Tillmann & Miron, 2020). Although previous research has examined the needs of various user groups (Miles & Leinster, 2010; Vassiliadis et al., 2013), there remains a gap in understanding how to support-decision making related to value generation in the design of HBE.

Past research on value generation in the HBE can be categorised into three main areas: (i) assessing the impact of specific HBE characteristics on patients' clinical outcomes (Zhang et al., 2019); (ii) identifying cause-and-effect relationships to inform design decisions (Durmisevic & Ciftcioglu, 2010); and (iii) examining how HBE shapes end-users' perceptions (Azila-Gbettor et al., 2013; Hamed et al., 2017). While these studies offer valuable insights, none have explored how HBE interact with healthcare service delivery or contribute to overall value generation (Lusch & Vargo, 2006; Zeithaml et al., 2020).

The research presented in this paper adopts the Means-End Chain (MEC) conceptual model (Gutman, 1982) to analyse value generation by linking product attributes to users' values through the consequences of product use (Gruber & Frugone, 2011). Based on this model a visual tool, named Hierarchical Value Map, can be developed, providing insights into how value is generated (Reynolds & Olson, 2001). Originally applied in business and marketing (Reynolds & Gutman, 1988), particularly in the food and tourism industries (Borgardt, 2020), the MEC model has been used to evaluate social housing projects (Hentschke et al., 2014;

Monteiro & Miron, 2018). However, its application to HBE remains limited (Kumar et al., 2020).

This research aims to propose a method to understand value generation in HBE by examining the relationships between built environment attributes and healthcare service delivery, from the perspectives of multiple user groups. This method outlines a systematic approach for collecting, processing, and analysing data from healthcare facilities to identify key areas associated with value generation. Furthermore, it creates a clear, visual representation of the relationships between HBE attributes, service characteristics, and the abstract users' values.

Design Science Research (DSR) was the methodological approach chosen for this investigation, as it is well suited to address real-world problems (Van Aken, 2004) by creating solutions that serve human purposes (March & Smith, 1995). The proposed method was developed and tested in two empirical studies conducted in different hospital units: an Intensive Care Unit (ICU) and a Paediatric Emergency Unit (PEU).

LITERATURE REVIEW

Healthcare Built Environments: services and users

Healthcare services are central to the design of HBE, as building layout and attributes should facilitate healthcare processes (Fitzsimmons & Fitzsimmons, 2005). Hollnagel (2014) presents a broad understanding of the built environment, defining it as built system designed to provide a certain service or functionality, thereby facilitating particular types of activities. The term 'system' is important, denoting an ensemble of interconnected environments and their associated attributes (Hollnagel, 2014). This research adopts an expanded definition when referring to the HBE, considering a wide range of dimensions, such as environmental comfort

(e.g. temperature, noise), space (e.g. layout, flows), and wayfinding (Bitner, 1992; Tzortzopoulos et al., 2009).

The interplay between healthcare services and HBE is evident in distinct examples, such as the one highlighted by Lavender et al. (2020) of a sonographer conducting an exam in a poorly designed hospital room. Instead of focusing on her task, she had to wait for other activities to finish, rearrange furniture, and search for available electrical outlets. This illustrative example demonstrates how design decisions should be based on the requirements of service flows, as suggested by Fitzsimmons & Fitzsimmons (2005).

Previous research has explored the relationship between the built environment and healthcare service delivery. For example, Kotler (1973) examined atmosphere and physical attributes, emphasising that building design can influence behaviour by e.g. increasing or decreasing likelihood of purchase. Building on this, Baker & Lamb (1992) incorporated factors such as communication, patient welfare, and perceptions of service quality into their analysis of the built environment. Similarly, Bitner (1992) and Hutton & Richardson (1995) examined how physical settings shapes users' perceptions and behaviours, influencing key outcomes such as perceived quality, value, satisfaction, and the intention to return or recommend the service. While their findings differ in emphasis, they collectively underline the significant role of the physical environment in healthcare delivery. Consistent with these earlier studies, more recent research continues to highlight the built environment’s influence on user behaviour (Batra & Taneja, 2023; Ghosh & Sahoo, 2018; Martens et al., 2022).

Design decisions are typically made by stakeholders such as owners, managers, and designers, who may not be involved in daily healthcare service operations (Shortell, 1983; Watkins et al., 2008). Therefore, it is essential to provide these decision makers with information on the requirements of different user groups, including service providers and patients (Bitner, 1992). Understanding the entire user journey, including all service encounters,

i.e. interactions between service providers and end-users, is crucial for analysing service experiences (Voorhees et al., 2017). Figure 1 presents the main classifications of service providers and end-users commonly adopted in the literature.

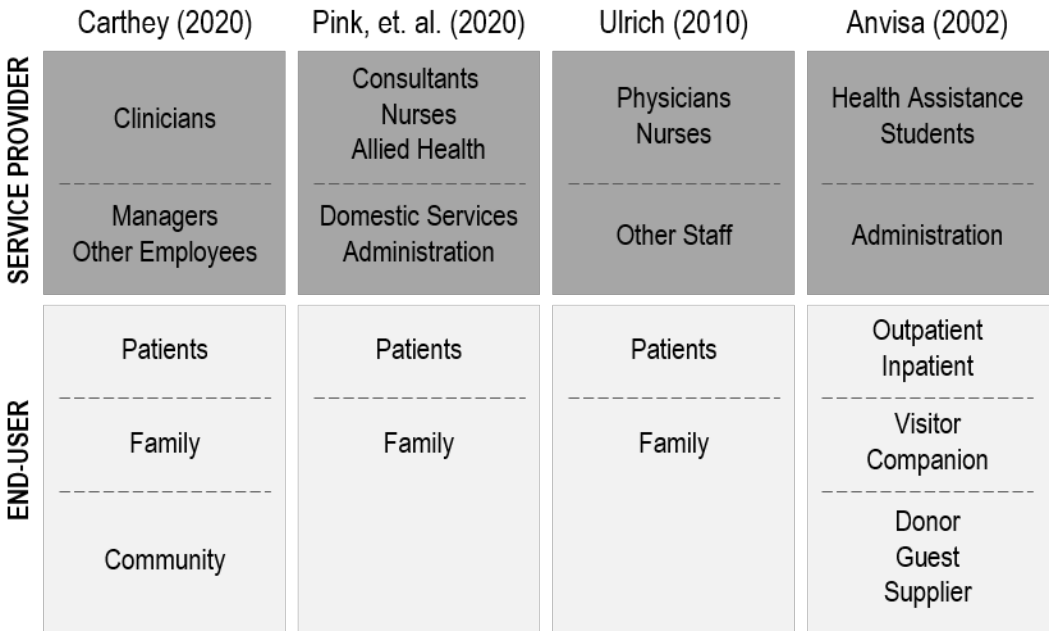

Figure 1: HBE main users according to the literature

Clinicians, allied health professionals, and nurses, are in charge of healthcare services (NHS, 2022). Administrative and support staff, such as ward clerks, medical secretaries, facility managers, and maintenance personnel, handle management and operational tasks (Anvisa, 2002; Pink et al., 2020). In this study, we define as end-users patients and their companions, including family members, friends, or caregivers who accompany them during treatment, as proposed by Davidson et al. (2018), as these stakeholders are the most directly affected by the effectiveness of healthcare services.

The experiences of users provide critical insights for identifying HBE requirements (Baker & Lamb, 1992). However, conflicting needs and priorities between different user groups can make it difficult to prioritise requirements, and trade-offs between requirements may be necessary (Sommer, 1969). For example, process transparency may enhance service efficiency

for providers (e.g. nursing staff), but could compromise patient privacy (Baldauf et al., 2021). Turley and Fugate (1992) emphasise the importance of integrating multiple stakeholder perspectives, as balancing these viewpoints is essential for effective HBE design and value generation (Teixeira et al., 2012).

The Multidimensional Nature of Value

Different theoretical approaches to understanding value have led to various interpretations in the literature (Woodall, 2003; Woodruff, 1997). From a philosophical perspective, value has been conceptualised as a motivational force that drives human actions by fulfilling needs (Shillito & De Marle, 1992).

In healthcare, it is important to understand the concept of value from both institutional and user perspectives. From an institutional angle, value plays a vital role in shaping corporate strategy, alongside mission, vision and goals (Schwartz & Cohn, 2002). Some healthcare organisations define value as part of their strategic goals (Porter & Teisberg, 2007). For users, perceived value stems from assessing a product or service based on the perceptions on what is provided and what is received (Zeithaml, 1988). According to Holbrook (1999), perceived value is the result of the interaction between an individual and a service or product, making it context-dependent and varying between individuals, locations, and time (Sánchez-Fernández & Iniesta-Bonillo, 2007). It is also relativistic, as it is comparative, personal and situational (Holbrook, 1999; Yrjola, 1995). The complexity of the perceived value concept, combined with the need to account for the perspectives of diverse stakeholders, makes value generation a challenging goal to be achieve in healthcare facilities.

The literature identifies two main approaches to understanding the nature of value: a unidimensional perspective, which emphasises the trade-off between benefits and sacrifices, and a multidimensional perspective, which conceptualises value as comprising several interrelated dimensions (Sánchez-Fernández & Iniesta-Bonillo, 2007). As mentioned in the

78 introduction, the research here reported adopts the multidimensional perspective, viewing
79 value as a context-dependent concept shaped by multiple dimensions that vary across
80 individuals, situations, and physical settings.

81 The multidimensional view of value is grounded in the idea that users perceive value
82 through a purpose-oriented lens, which can be modelled by using a hierarchy of constructs
83 (Woodruff, 1997). Gutman (1982) proposed the Means-End Chain (MEC) conceptual model,
84 in which 'means' are products, services or activities which people engage in, while 'ends' are
85 the desirable outcomes for individuals (Gutman, 1982; Veludo-de-Oliveira et al., 2006). In that
86 model, relationships between product attributes, consequences of use, and costumer objectives
87 are established (Vriens, 2000; Woodruff, 1997). The MEC model is generally represented in
88 three hierarchical levels – attributes, consequences and values (Reynolds & Gutman, 1988).
89 However, more subdivisions have been adopted in past research (Reynolds & Olson, 2001;
90 Hentschke et al., 2014), to differentiate and organise constructs, as illustrated in Figure 2. The
91 closer the hierarchical level is to the top, the more abstract the construct is; by contrast, the
92 closer it is to the base, the more concrete it is.

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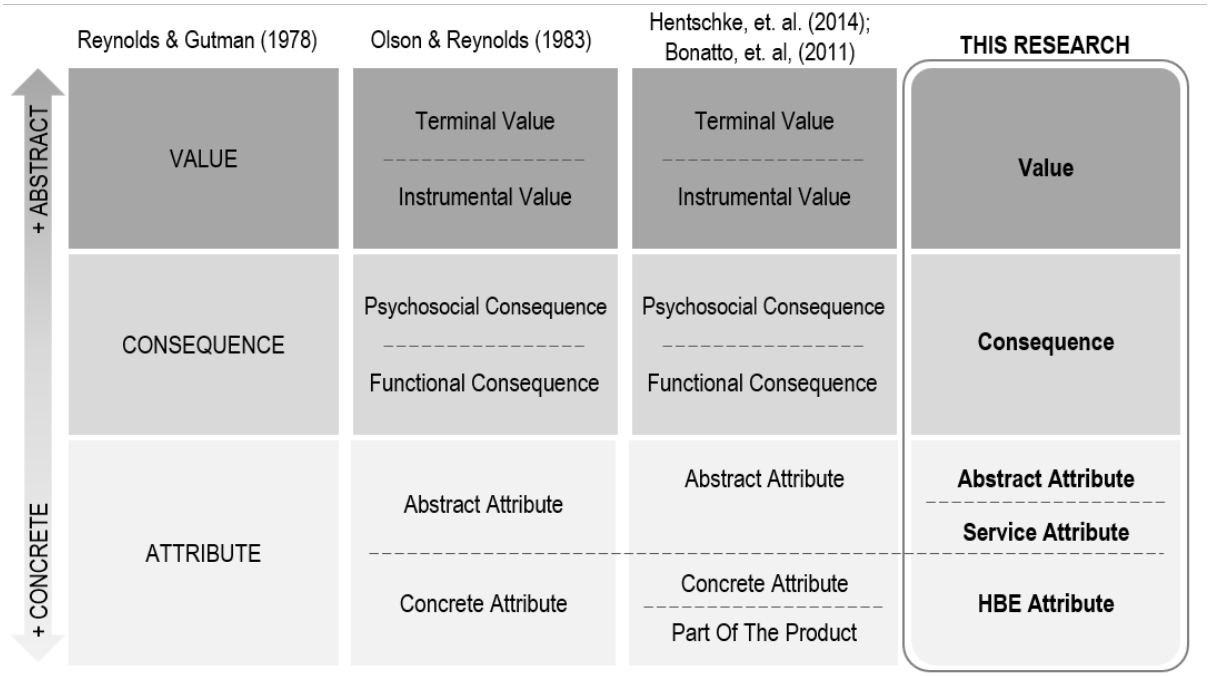


Figure 2: The MEC Levels of abstraction

At the **attribute** level, the focus is on product or service characteristics, representing the materialisation of consumer values (Claeys & Abeele, 2001). These attributes can be classified into concrete attributes, referring to physical aspects, and abstract attributes, which are non-physical features, e.g. ambience (Klenosky et al., 1993; Lin, 2002). Previous research classified "parts of the product" as another category of attributes, which refer to specific spaces, such as a room in a building, or components, e.g. floor finishings (Miron et al., 2025; Hentschke et al., 2014).

The **consequence** level arises from the interaction between consumers and attributes (Gutman, 1982). Veludo-de-Oliveira et al. (2006) pointed out the difference between consequences that represent an immediate functional outcome (e.g., eat less) and those that have a psychological nature (e.g. don't get fat).

At the **value** level, a chain is formed by connecting personal values and life goals (Gengler & Reynolds, 1995), which may be instrumental (intermediate goals) or terminal (final goals) (Lin, 2002).

The research here reported maintains the original hierarchical levels of values and consequences proposed by Reynolds & Gutman (1988), while introducing new subdivisions for attributes as an adaptation of the model to healthcare environments: (i) *HBE-related*, which focus on specific sectors and physical components; (ii) *service attributes, which* encompass key user activities mapped in service encounters (Shostack, 1982); and (iii) *abstract attributes* as defined by Reynolds & Olson (2001).

Laddering is the most common modelling technique used to apply the MEC conceptual model (Leppard; et al., 2004). It maps connections between different levels of abstraction (Veludo-de-Oliveira et al., 2006), and captures the reasons why something is important, based on in-depth interviews (Reynolds & Olson, 2001). Responses are analysed, and key constructs are identified and organised into "ladders" (Reynolds & Olson, 2001). This process results in a Hierarchical Value Map (HVM), which visually represents the relationships between constructs at different levels of abstraction (Reynolds & Gutman, 1988). The laddering technique has been used in previous studies for modelling value generation in social housing projects (e.g. Hentschke et al., 2014; Miron et al., 2025). HVMs are valuable to visualise the most relevant constructs, their level of abstraction, and their interconnections (Gruber & Frugone, 2011). Ultimately, HVMs help clarify how value is generated for costumers or users, moving from concrete attributes to highly abstract values (Gengler & Reynolds, 1995).

RESEARCH METHOD

Research approach

Design Science Research (DSR) was the methodological approach adopted in this investigation. DSR aims to develop general solutions, named solution concepts, to solve

problems in a limited range of situations (Holmström et al., 2009; Van Aken, 2004). Van Aken (2004) outlines three steps for conducting DSR: (i) understanding the problem, (ii) developing and applying the solution; and (iii) evaluating the solution and reflecting on both theoretical and practical contributions. A theoretical understanding of the subject, often paired with empirical studies, is essential for creating and assessing the proposed solution (Hevner et al., 2004; March & Smith, 1995).

DSR research outputs are typically categorised as: constructs (concepts that are specific to a context); models (relationships between constructs); methods (a set of steps to achieve a goal); or instantiations (the application of the output in a real situation) (March & Smith, 1995). In this study, the main outcome is a method that consists of a series of steps designed to generate knowledge that improves value generation in HBEs, based on the MEC conceptual model (Gutman, 1982).

Research design

The point of departure was the literature review on value management and healthcare services. Based on the a gap in knowledge, a research question was formulated: "*How can the value generated by a HBE be understood, considering healthcare services and the perspective of different users*?"

Two empirical studies[1] were developed in different Brazilian hospitals, i.e. an Intensive Care Unit (ICU) and a Paediatrics Emergency Unit (PEU). These were selected due to their complexity, importance, and also for the existing academic collaboration between the hospitals and the research institution. They had many differences in terms of HBE requirements, which was useful to test the scope of applicability of the method as a solution concept. Due to the

1 In DSR, the expression empirical studies is often used, instead of case studies, in order to make it clear that the case study research strategy, a descriptive-explanatory methodological approach, has not been used. In DSR, empirical studies often involve the development, implementation and assessment of a solution concept (Holmstrom et al., 2009).

limited availability of resources, only two empirical studies were carried out. Table 1 presents the main characteristics of each empirical study.

Table 1 Description of Empirical Studies

	EMPIRICAL STUDY 1	**EMPIRICAL STUDY 2**
Hospital profile	Hospital A: University hospital	Hospital B: Private hospital
Unit specialization	ICU	PEU
Reference	National reference in ICU	Regional reference in PEU
Placement in the Hospital	2 units on the 13rd floor	500m² on the ground floor
Unit's capacity	34 inpatient beds	47-bed inpatient unit 1outpatient unit
Service characteristics	24-hour service daily, Around 200 employees within 14 professional areas	24-hour service daily Operates in conjunction with the hospital's paediatrics service

The research was conducted in three phases, as illustrated in Figure 3, following the steps proposed by Van Aken (2004). In **Phase 1**, the focus was to understand the practical problem, i.e. the context (type of organisation, end-users, main services, etc.), and the characteristics of the buildings in each study. **Phase 2** consisted of developing the method and applying it in the two hospital units, enabling its refinement.

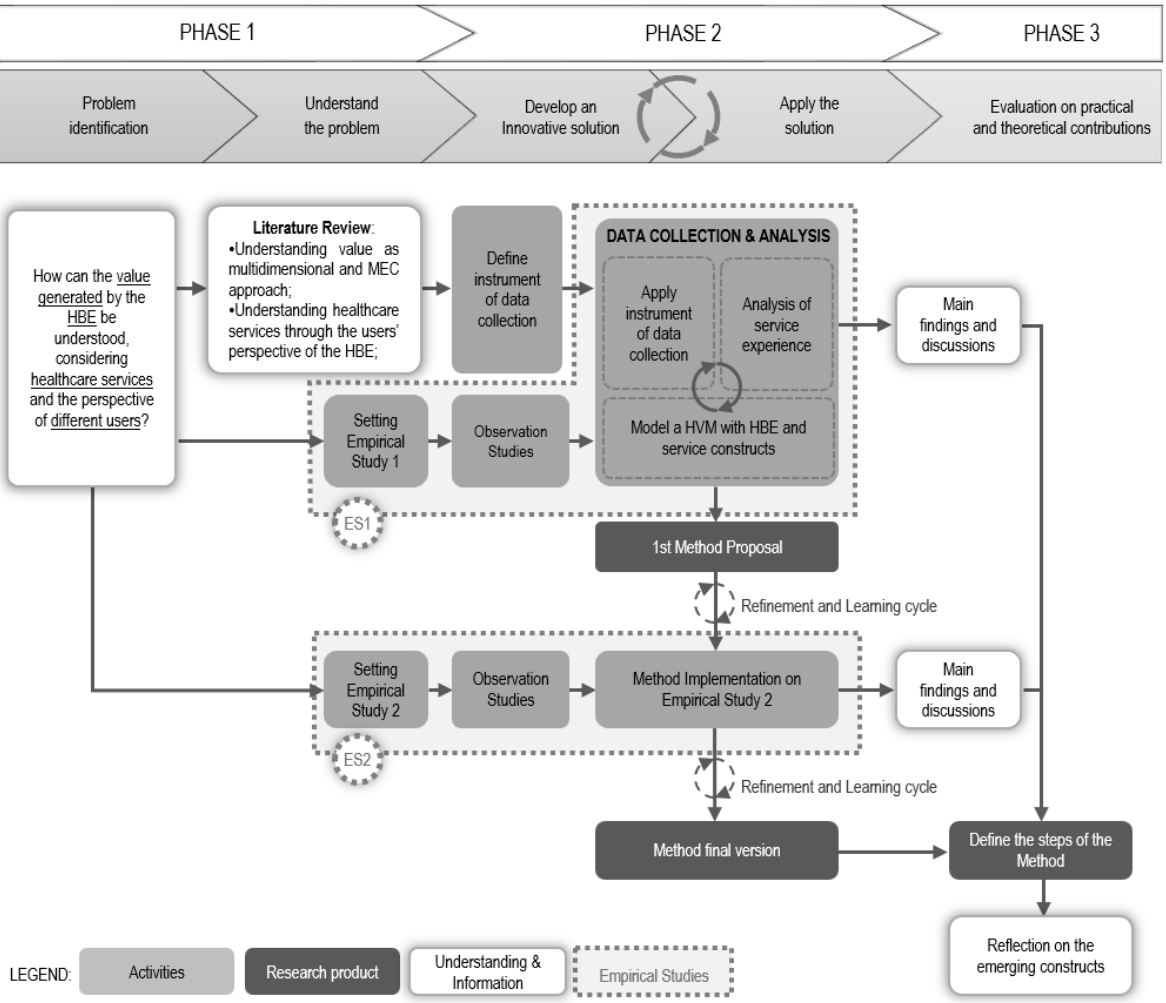


Figure 3: Research design

Phase 3 consisted of the assessment of utility and applicability of the final version of the method, as suggested by March & Smith (1995). Utility determines whether the method effectively solves the problem, while applicability refers to how easily it can be implemented in practice.

Methods of data collection and analysis

Data Collection was conducted in both hospitals after ethics committee approvals and written consent from every interviewed participant. To achieve greater reliability of the information, multiple sources of evidence were used, as described below.

Document analysis included floorplans and the strategic plan from each hospital, alongside the RDC-50[2] regulatory requirements of ANVISA (Brazil's National Health Surveillance Agency) (Brasil, 2002). The floorplans analysis was essential in understanding the impact of layout on service delivery flows, while the strategic plan provided insights into the hospital's priorities and guiding values.

Non-participant observations (Robinson, 2011) were conducted to grasp the context of service delivery and the main interactions between users. This consisted of observing processes and the surrounding environment, without any intervention from the researcher in the activities being carried out.

Following, semi-structured interviews with HBE users were undertaken. The interviews' first section focused on the staff's routines or the end-user experience, prompting the interviewees to describe their roles and activities, as well as their perception on patient's experience whilst in the hospital. The second section was used to apply the soft-laddering technique (Reynolds & Olson, 2001). This technique was selected to emphasise interviewees' perceptions, rather than pre-defined products or services (Reynolds & Gutman, 1988), and it followed an approach of asking 'why' interviewees had their perceptions (e.g. liked or disliked something), five times. The number of respondents was determined by theoretical saturation criteria (Eisenhardt, 1989), i.e. the interviews were concluded when no new relevant information emerged. Caregivers were also interviewed, as the implications of caregivers' presence are considered very important in healthcare (Wolff & Roter, 2011; Davidson et al., 2018). In the specific context of this research, caregivers play a central role (Brown et al., 2008) as their emotional state also has a direct impact on the child, and their anxiety can heighten the

2 RDC-50 is a Brazilian technical regulation for Healthcare Built Environments, regarding planning, programming, preparation and evaluation.

child's stress (Hamdan et al., 2016). This indicates the importance of addressing caregiver wellbeing as part of the patient care process (Davidson et al., 2018; Wolff & Roter, 2011).

A qualitative **data analysis** approach was adopted, following the steps of the laddering technique. Constructs were identified through interviews and triangulated with the results from the literature. These emerging constructs were grouped into preliminary codes reflecting key constructs such as attributes, consequences, and values. Subsequently, the interviews were reanalysed using this code structure to ensure alignment with the theoretical framework adopted in this research. The final set of codes were organised into hierarchical levels, as outlined in the section 'The Multidimensional Nature of Value' above. It is also worth noting that the interview results were first analysed separately for patients and staff. Following that a general map was created including constructs from all interviewee groups.

To facilitate data storage and processing, the online software package LadderUx was used, supporting content analysis and visualisation (Hentschke et. al., 2014). The coded constructs were input into LadderUx, where algorithms determined the frequency of construct citations and the connections between them, ultimately generating a Hierarchical Value Map (HVM).

The HVM produced with all cited constructs and connections by the interviewees results in a very complex map. For that reason, a cut-off point must be defined to simplify interpretation (Leppard et al., 2004). While it is common to map connections at various cut-off levels to find the most interpretable representation (Reynolds & Gutman, 1988), testing different levels in this study yielded either overly complex maps or too simplistic ones. An intermediate cut-off point was therefore chosen and set in LadderUx, capturing around 50% of the connections.

Constructs were deemed to have a high "centrality" if they displayed numerous connections with other constructs (van Rekom & Wierenga, 2007; Wasserman, 1994). These constructs were highlighted in the resulting HVM by using thicker lines to indicate their centrality (Klenosky et al., 1993).

Despite the contribution of LadderUx, the initial output contained overlapping lines that hindered interpretation. To enhance clarity, a refined visual representation of the map was manually created, maintaining the meanings and connections defined by the software.

The method was evaluated through analyses conducted by the authors in EE1 and EE2, supplemented by a focus group held with hospital representatives in EE2. The assessment examined the method's effectiveness in understanding value generation and its potential applicability to other HBE. Due to COVID-19 restrictions, an external evaluation was not possible. Therefore, as the external evaluation was not feasible, the assessment remains partial, highlighting the need for further research to enable a more comprehensive evaluation of the method. Table 2 outlines the sources of evidence used in this investigation.

Table 02 Sources of evidence used in each Empirical Study

	EMPIRICAL STUDY 1	**EMPIRICAL STUDY 2**
Analysis of documents	floorplans hospital's strategic plan	floorplans hospital's strategic plan
Non-participant observation	14,5 hours	6 hours
Semi-structured interviews	Total: 10h 46min 30 service providers 8 end-users	Total: 13hours 57min 29 service providers 5 end-users
Focus Group	[It was not conducted due to the pandemic context]	Total: 1hour 30min 2 researchers 2 key service providers

RESULTS

Description of the i3 method

The proposed "i3 method" is the main outcome of this research. This is one of the types of outputs possible from a Design Science Research study (March & Smith, 1995), highlighted in the previous section.

The "i3 method" has three phases: (i) Investigation; (ii) Interpretation; and (iii) Implication (see Figure 4). It has been designed for application in three possible scenarios: (i) building refurbishment projects, to assess existing HBE and inform designers on how to improve user value; (ii) new building designs, to gather insights from similar HBE to support the development of a new building design; and (iii) research, for conducting in-depth studies on value generation. Thus, the method is intended to be used by both practitioners (e.g. designers or project managers) and researchers.

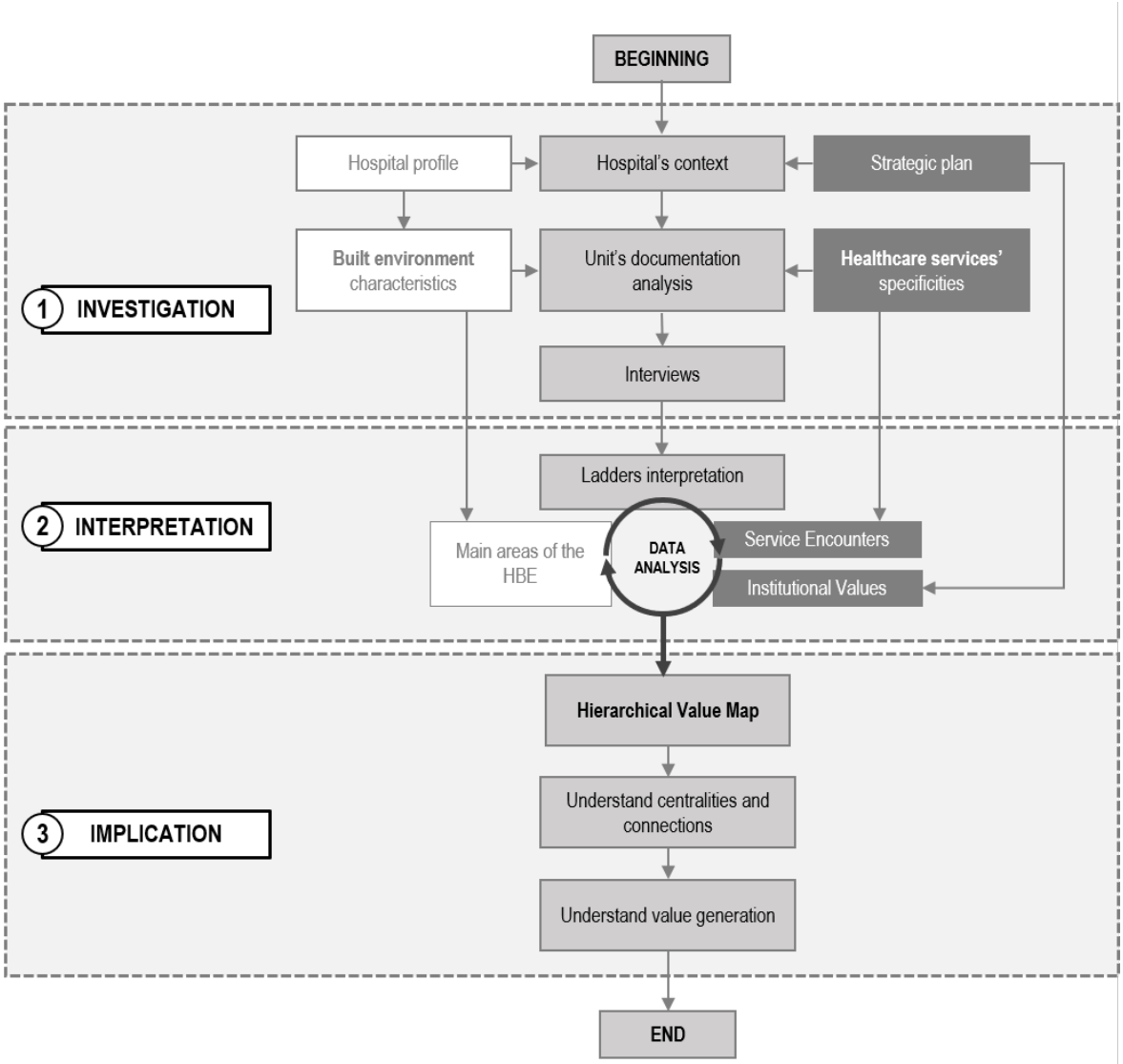


Figure 4: The I3 method to understand value generation in HBE

Each of the method's phases is distinct yet interconnected. The process begins with the **investigation** phase, focusing on contextualisation and data collection. This is followed by the **interpretation** phase, involving organisation and analysis of the collected data. Finally, the **implication** phase consolidates the results into a meaningful output, the HVM, offering theoretical insights and practical information to inform design decision-making. Each phase is explained in detail below.

Phase 1: *Investigation*

Phase 1 aims to develop a comprehensive understanding of the healthcare facility under investigation. The specific activities undertaken may vary depending on the method's user. Internal hospital staff, given their experience, may already possess substantial knowledge of the facility, whereas for external design teams or researchers, this phase is essential for data collection. The nature of the data collected is determined by the healthcare unit's specific context and the hospital's strategic priorities.

A document analysis of the healthcare unit is conducted by reviewing architectural plans and regulatory standards. Additionally, observations are carried out to examine users' interactions with the space, including spatial layout, furniture arrangements, and workflow dynamics. This observational process also aids in identifying key user groups for subsequent interviews.

Following this, semi-structured interviews are conducted with staff, patients, and family members. The interview guide (see Appendix A) comprises five sections: (1) interviewee profile; (2) HBE spaces utilised; (3) description of routines and experiences; (4) *soft-laddering*, assessing positive and negative perceptions of the healthcare unit; and (5) general observations.

To facilitate participation, it is essential to clearly communicate the objectives of the method to service providers. Invitations should be extended to professionals across various professional roles, while patients and family members should only be approached if they are both able and willing to participate, ensuring minimal disruption to clinical care. As interviews must be conducted until data saturation is reached, data analysis should ideally occur concurrently with the interviews.

Phase 2: *Interpretation*

In phase 2, data from the first phase is thoroughly analysed. The three sources of evidence - documents, direct observations, and interviews - were triangulated to ensure accuracy and

reliability. The laddering technique is applied to process data collected in the semi-structured interviews.

A coding process is employed to organise data into hierarchical levels of abstraction: attributes, consequences and values (Reynolds & Olson, 2001). In this research, attributes are further subdivided into: HBE (e.g. floorplan areas), service encounters related to main healthcare operations, and abstract attributes (e.g. aesthetics and environmental conditions - Lin, 2002).

Following that, a software package (e.g. LadderUx) can be used to generate an implication matrix and an initial HVM. This allows a quick visualisation of how different constructs contribute to value generation, offering a representation to support decision-makers involved in design or project management.

Phase 3: *Implication*

The HVM is presented at phase 3, highlighting key constructs and their connections**.** Strategic institutional values can be added to the HVM and compared with the values that have emerged from the map.

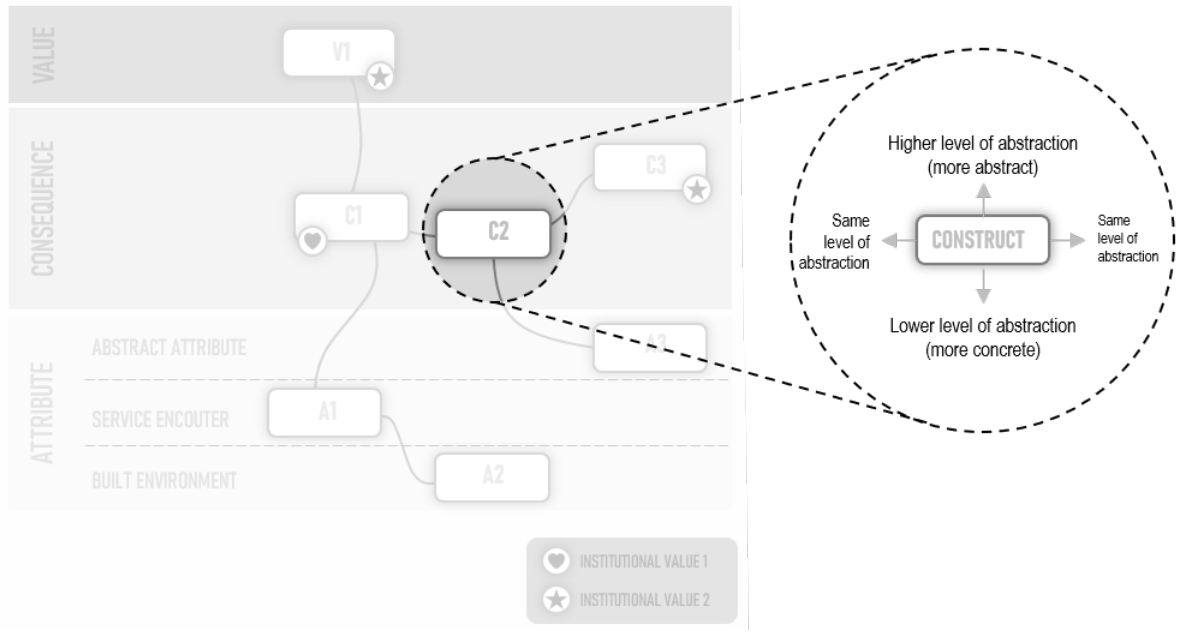


Figure 5: Proposed HVM

Each construct is represented by a box, with lines connecting it to other constructs. **Intra-level connections occur within the same level of abstraction, while inter-level connections link constructs across different levels. Lines originating at the top of a box connect to higher abstraction levels; lines at the bottom connect to more concrete constructs; and lines from the sides establish connections within the same level of abstraction.**

Following the generation of the visual HVM, the final step involves identifying constructs with high centrality, determined by the number of connections they have with other constructs. Those with numerous connections should be highlighted, as they play a pivotal role in understanding value generation.

Instantiations of the i3 Method

Empirical study 1

Investigation phase

The method was initially applied at the ICU, which provides specialised, intensive and interdisciplinary care to patients, involving advanced diagnostics and therapeutic equipment (Marshall et al., 2017). The ICU is one of the hospital areas with the highest concentration of sophisticated biomedical technologies (Fontaine et al., 2001). The ICU floorplan for Empirical Study 1 includes circulation, assistance, reception/waiting and administrative/support spaces, as illustrated in Figure 6.

Figure 6: Floorplan of the ICU

As the ICU is located at the 13th floor of the hospital, the circulation areas serve as vital connectors between different hospital sectors. The core zone of the ICU is the assistance area, dedicated to patient evaluation and treatment. Table 3 outlines the main activities in each sector and the users involved.

Table 3 ICU: built environment and healthcare services map

EMPIRICAL STUDY 1: Intensive Care Unit				
WHAT Main activities	**HOW** Activity description	**WHO** Main user(s)	**WHERE**	
			sector	floorplan
Arrival	First contact of the user with the hospital unit	P F S	**Circulation**	Hallways, stairs and 7 lifts
Patient Transport	When the patient needs to access a service from another unit	P S		
Leave Unit	Last contact of the user with the hospital unit	P F S		
Host / Reception	Receive the family member	F S	**Reception and waiting**	Reception, seats for waiting and restrooms for family members
Waiting	Wait for updates or for visits	F		
Clinical Care	Comprises the patient constant care routine.	P S	**Assistance**	34 inpatient beds; 3 nursing stations; 3 Medical offices; and 5 isolation rooms
Medicines' access	Access and release of medicines for service providers	S	**Access to medicines**	1 Satellite pharmacy
Family experience	Family members activities, e.g. meetings, updates and visits	P F	**Support and Administration**	1 family room
Administrative matters	Monitor admission, deaths, discharges and transports; Manage resources and equipment's requests; e-mails, calls, meetings;	S		2 management rooms, s, 1 adm. office
Support	Maintenance and technical activities; patients' meals preparation	S		4 machine rooms, 5 utility rooms, 1 small kitchen
Attire	Change personal clothes for hospital's attire and wear personal protection.	S		3 restrooms, 1 snack room for service providers, 2 on-call room
Break	Rest pause throughout the work shift	S		
Team change	Verify shift data with the previous/following team	S		
		Legend	P Patient F Family S Service Provider	

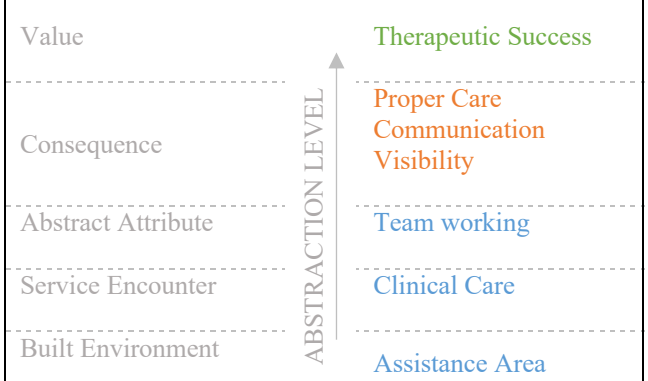
Thirty service providers (79% of the total) were interviewed, including clinicians (9); allied health professionals (12); and administrative/support staff (9). By contrast, only 8 end-users (5 family members and 3 patients) agreed to take part in the research.

Interpretation phase

In the Empirical Study 1, 49 constructs emerged from interviews and from the analysis of the institutional values (see Appendix B). Those constructs had 683 direct links and 986 indirect links between levels of abstraction. As mentioned in the research method section, a cut-off point was established to simplify interpretation. The limit established was four relationships, resulting in a map that displayed 57.6% of the identified links.

Table 4 provides an example of content analysis from one interview: although service provider #26 have not explicitly mentioned "care assistance", triangulation with other data revealed its connection to higher abstraction levels.

Table 4 Example of the raw data of the interview and resulting ladders and constructs

Raw data	**Final ladders and constructs**
The integration of the **assistance area** allows **visual access** to the entire **workspace**. It allows easy and **constant surveillance**. It enables visual **communication** with **colleagues** even from a distance, making the **workflow** easier. Also, it ensures the patient safety without compromising **health outcomes**. - Data from the Interview with Service Provider #26	

The institutional values of the hospital are: (1) Respect for people; (2) Technical skills; (3) Teamwork; (4) Institutional engagement; (5) Austerity; and (6) Social responsibility. These values were compared to the constructs of the HVM, to assess how well they were aligned with the perceptions of users.

Implication phase

The visual representation in Figure 7 highlights the primary constructs and relationships identified in the ICU. With the defined cut-off point, 42 constructs appeared in the final HVM.

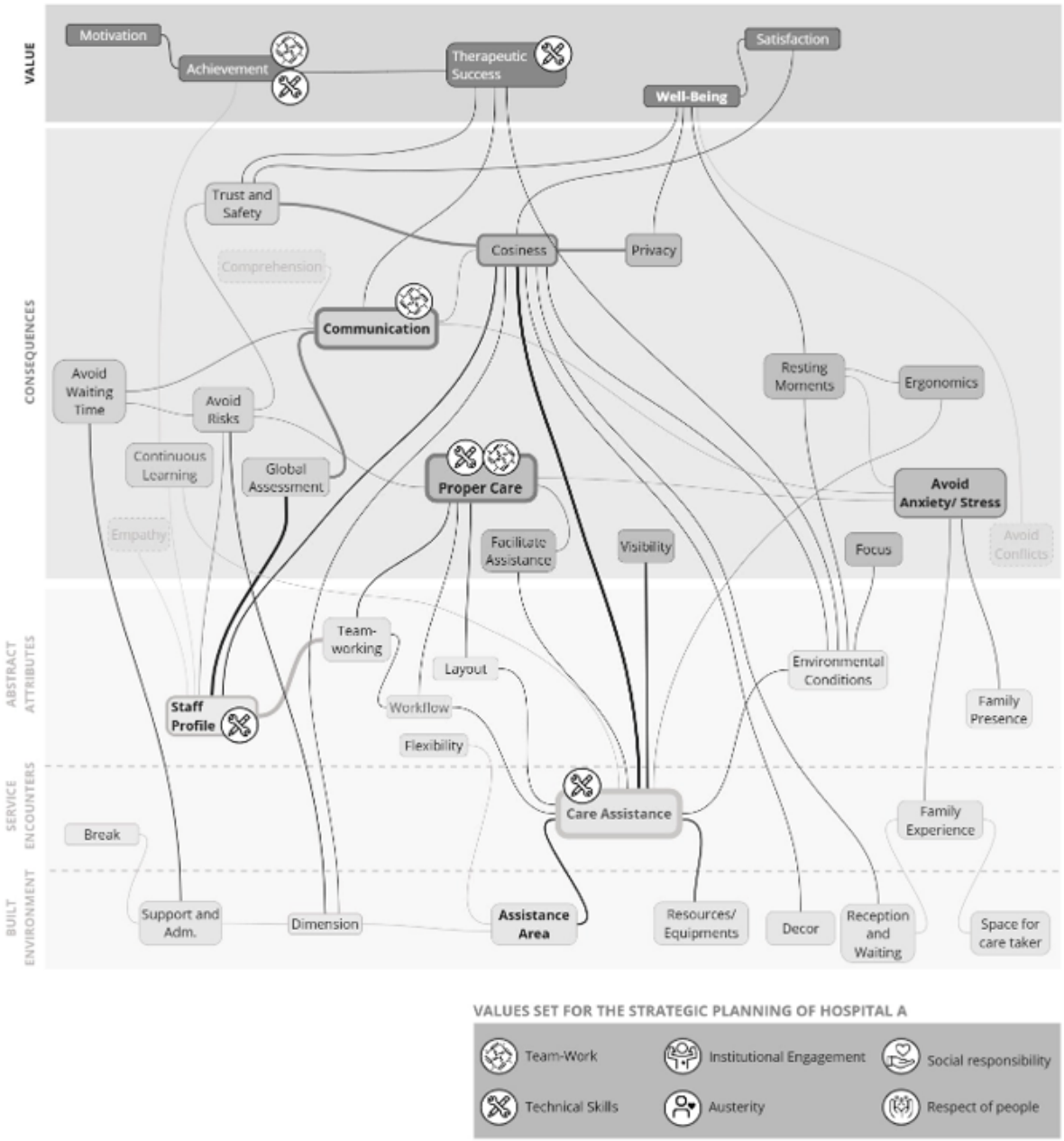


Figure 7: Empirical Study 1 - Final visual device for the Intensive Care Unit

At the attribute level, 'care assistance' emerged as the most central construct with 107 direct links and 131 indirect links (see Table 5). For staff, this construct represented the core purpose of their work, while end-users see it as the reason for seeking ICU services. Due to the fragile condition of ICU patients, **'care assistance'** was closely tied to the availability of '**equipment and resources'** and '**assistance area'**, highlighting the interdependency of these elements in

ensuring high-quality care. Additionally, the staff skills, experience and expertise were pointed out as extremely important, due to the direct impact on therapeutic success.

Table 5 Level of centrality of some constructs

Abstraction level	Construct	Sum of Links: Direct | Indirect	Level of Centrality[3]
Attribute of Service	Care Assistance	107 |131	0,073
Consequence	Proper Care	102 |144	0,069
Consequence	Communication	94 |119	0,064
	[…]		
Value	Well-being	59 |154	0,040
Abstract Attribute	Staff Profile	54 | 145	0,037
	[…]		
Attribute of the HBE	Assistance Area	46 |146	0,031
	[…]		
Attribute of the HBE	Reception & waiting	6 | 11	0,004

Another central construct was **"wellbeing,"** which represents a key high level user value linked to positive outcomes. Staff associated wellbeing with the need to avoid stress and burnout, critical for delivering effective care. For patients and family members, it was tied to their ability to cope with the emotional challenges of the ICU experience.

Three key service encounters were identified: **"care assistance"; "service breaks"** (noted by staff), and **"family experience"** (emphasised by end-users). Each of these service encounters was associated with specific built environment attributes:

- **Clinical care** and the **assistance area;**
- **Service breaks** and the **support and administrative areas;**
- **Family experience** and the **space for care givers;**

[3] The level of centrality is a metric used to determine how important a concept is within the HVM. It is automatic generated by LadderUx and calculated by summing how often a concept leads to others and how often it results from others, then dividing this sum by the total of all matrix entries. The closer the value is to 1, the higher the concept's level of centrality (Miles & Rowe, 2004).

These findings illustrate the interdependence between physical space and service delivery, as one reinforces the other and shapes user perceptions.

At the consequence level, **"avoid anxiety or stress"** stood out as another critical construct, particularly for family members. The primary connections involved spaces like the **reception and waiting areas** and the **space for care givers**, which supported family wellbeing during their ICU experience.

Although interviewees have not spontaneously mentioned institutional values, certain responses were aligned with those values. For example, **"technical skills"** and **"teamwork"** emerged, reflecting the hospital's strategic focus. However, other institutional values, such as **respect for people** and **social responsibility**, were less visible, indicating a potential gap in the alignment between institutional values and user perceptions. **This suggests the need for the hospital to better communicate and integrate these values in their operations and in the construction and maintenance of its built environment.**

Empirical Study 2

Investigation phase

In paediatric care, there are important differences from adult care, due to the varying anatomical, physiological, and psychological needs of children (Durch & Lohr, 1993). These distinctions influence clinical treatments and care environments. The Brazilian RDC-50 standard (Brasil, 2002) emphasises that paediatric spaces should be designed specifically to meet the needs of children. The Paediatrics Emergency Unit (PEU) is located on the ground floor, with two separate entrances: one connected to the Hospital's main reception, providing access to patients and families; and the other is reserved for ambulance access. Figure 8 illustrates the PEU floorplan.

Figure 8: Floorplan of Paediatric's Hospital Unit

In PEU, children are always accompanied by at least one family member throughout their care journey. The healthcare workflow begins with triage, directing patients either to treatment or observation. Table 6 provides a summary of the main activities, highlighting the corresponding users and the floorplan spaces where services occur. During the interview phase, temporary adjustments were made to the assistance area due to COVID-19 preventive measures: respiratory patients were treated in the medication room, while non-respiratory patients were placed in the observation room.

173 Table 6 Empirical Study 2: built environment and healthcare services map

EMPIRICAL STUDY 2: Paediatrics' Emergency Unit				
WHAT Main activities	**HOW** Activity description	**WHO** Main user(s)	**WHERE**	
			sector	Floorplan
Arrival	First contact of the user with the hospital unit.	P F S	**Circulation**	Hallways, 2 entrances, stairs and 1 lift
Patient Transport	When the patient needs to access a service from another unit of the hospital.	P F S		
Leave Unit	Last contact of the user with the hospital unit.	P F S		
Host / Reception	Receive the patient and family member in the unit.	P F S	**Reception and Waiting**	Reception, waiting seats, restrooms for patients and families, and a recreational area for children
Waiting	Wait for assistance or for information.	P F		
Patient triage	Patient classification according to their health condition.	P F S	**Assistance**	1 Triage room
Waiting	Wait for new patients demand	S		4 doctors' offices, 1 medication room (10 armchairs for patients + 1 nursing station) and 1 observation room (9 inpatient beds and 2 isolation rooms)
Clinical Care	Comprises the patient constant care routine.	P F S		
Medicines' access	Access and release of medicines for service providers to carry out and treat patients.	S	**Access to medicine**	1 Pixy's Area is set on the circulation area, restricted for nurses' usage
Bureaucratic matters	Monitor admission, discharges and transports. Answer calls and e-mails. Take part on meetings. Manage resources and equipment's requests.	S	**Support and Adm.**	1 adm. office, 2 restrooms,
Hospital attire	Change personal clothes for hospital ones and wear personal protection.	S		1 snack room for service providers, 2 storage room and 1 on-call room
Break	Rest pause throughout the work shift	S		
Team change	Verify shift data with the previous/following team	S		
		Legend	P Patient F Family S Service Provider	

174

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176 The hospital's strategic plan outlined eight core institutional values: (1) Excellence, (2)

177 Quality and safety, (3) Focus on results, (4) Union and collaboration, (5) Ethics and integrity,

178 (6) Kindness and compassion, (7) Social engagement, and (8) Empowerment and innovation.

Twenty-nine service providers were interviewed including clinicians (20); administration and support staff (7); and allied health professionals (2). Regarding end-users, only family members (5) were interviewed as the patients were children.

Interpretation phase

In Empirical Study 2, 58 constructs were identified (see Appendix A), yielding 795 direct links and 1383 indirect ones. To improve clarity, a cut-off point of four relationships was established, leaving 44 constructs in the final analysis, which accounted for 52% of the total relationships.

Implication phase

Figure 9 presents the HVM developed for Empirical Study 2. Similar to Empirical Study 1, the construct '**proper care**' exhibited the highest degree of centrality, with 118 direct links and 169 indirect ones. Despite being an abstract attribute, "**layout**" was connected to '**proper care**' and '**therapeutic success**'. "Layout" refers not only to the spatial arrangement of the PEU but also furniture, workflows, and connections of the PEU with other hospital units. This demonstrates the explicit relationship between the HBE and therapeutic success.

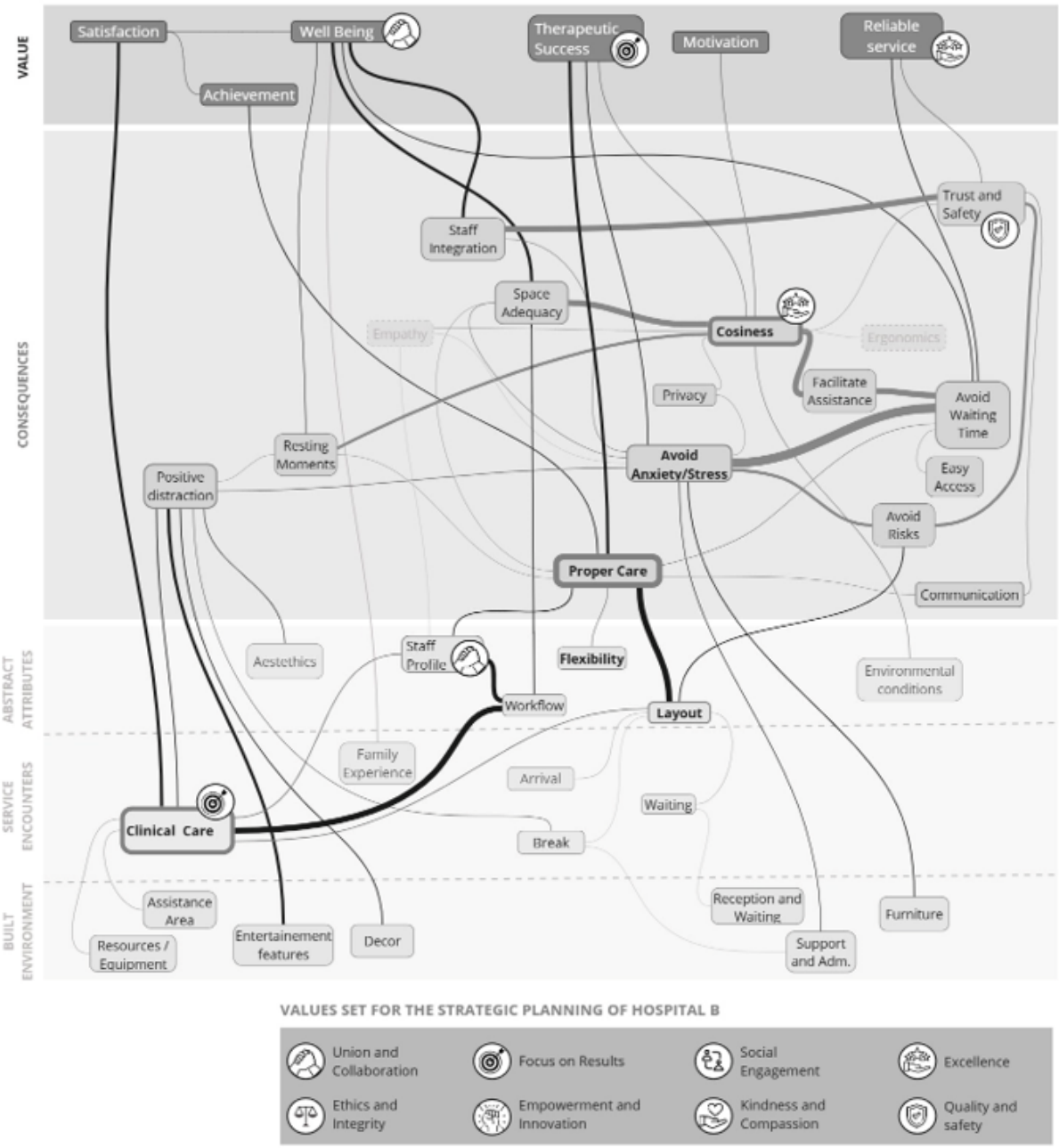


Figure 9: Empirical Study 2 - Final visual device for the Paediatrics Emergency Unit

The construct '**care assistance**' also had a high degree of centrality, with key connections to: **'assistance area'**; '**resources**'; '**layout**'; '**workflow**'; '**reliable service**'; and '**focus on results**'. Given that PEU patients typically have short stays (they are discharged or transferred), users' perception largely hinges on 'care assistance'. Ensuring positive outcomes and avoiding

complications is critical, and the layout and resources within the assistance area are vital in supporting these services.

The connection between HBE and service delivery is evident, with several direct relationships emphasising their interconnectedness. Some constructs form inter-level connections with consequences such as '**positive distraction**' and '**avoid anxiety/stress**', highlighting the role of the built environment in supporting care. In a paediatric setting, positive distraction plays an important role in calming children, with features like television and play area helping to reduce stress. Providing distraction for family members is equally important, as their emotional state impacts the child's wellbeing (Hamdan et al., 2016).

At the consequence level, **'cosiness'** and '**avoid anxiety or stress**' were particularly important constructs, linked to constructs such as '**privacy**', '**facilitate assistance**' and '**avoid waiting time**'. Direct connections between these constructs and 'furniture' and 'environmental conditions' further underline the importance of the HBE in shaping user experience. Additionally, '**cosiness**' was directly linked to the user's value of '**motivation**' and to the institutional value of '**excellence**'.

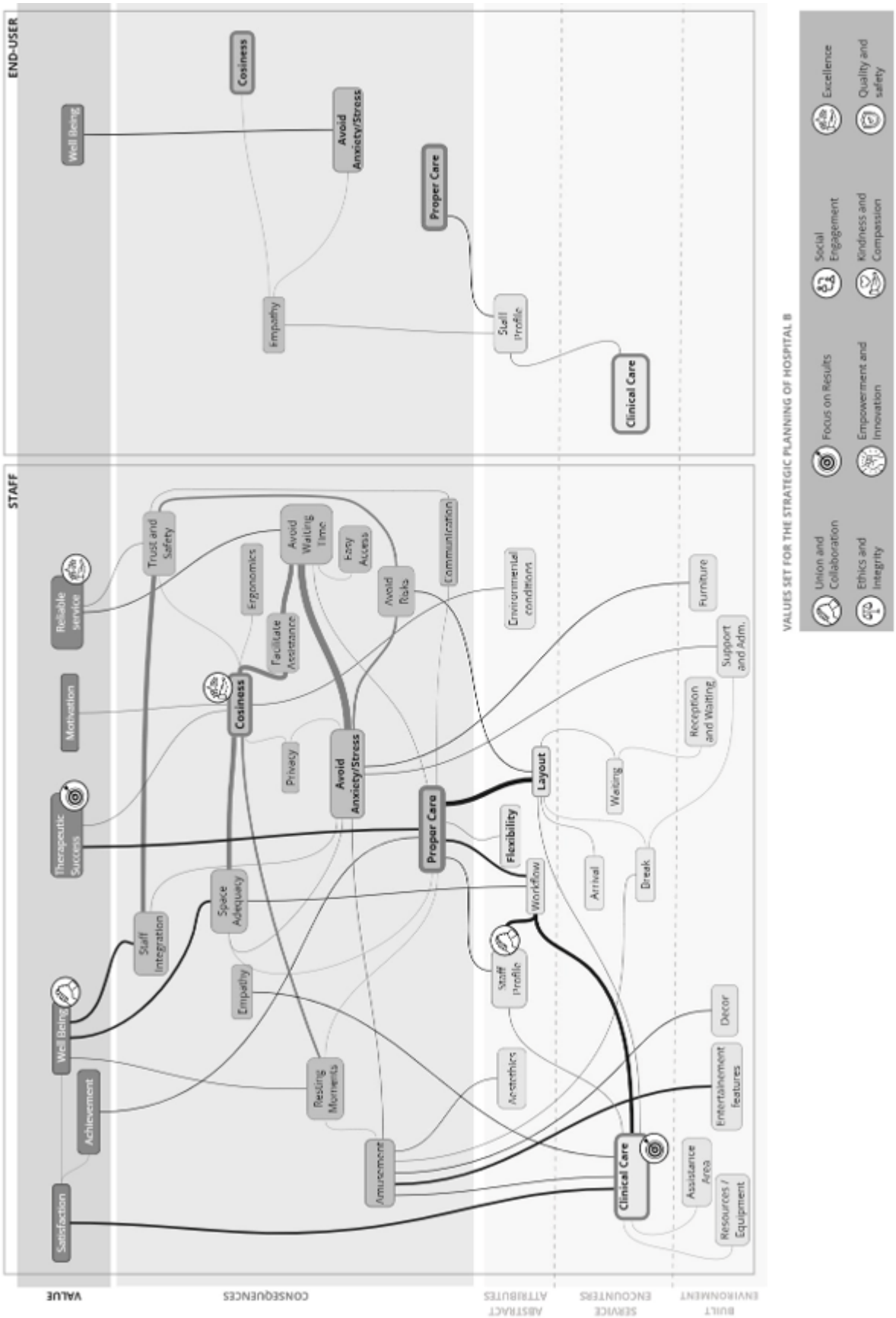
Despite the Hospital's strategic plans outlining eight institutional values, none of them emerged during the interviews. This pattern, similar to Empirical Study 1, reveals a disconnection between the values perceived by users and the institution's strategic plan.

Utility and applicability assessment of the i3 Method

Two key service providers participated in the focus group of Empirical Study 2, providing a positive response to the i3 method. They found the HVM useful for understanding value generation, and, with a brief explanation, they had no difficulty interpreting the results. Additionally, they stated that institutional values are consistently reinforced to team leaders. However, as revealed in the HVM, some values are not fully disseminated, as they were not mentioned in any of the interviews. While certain decisions remain non-negotiable for

administrators and designers, some participants suggested that the insights provided by the HVM should be incorporated into strategic planning reviews. **This would enable alignment between the organisation's long-term goals and the expectations of various user groups regarding the HBE**.

As a contribution, the group proposed creating separate HVMs for staff and end-users to better capture the similarities and differences in their perspectives. Consequently, two distinct HVMs were generated, as shown in Figure 10.



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234 **Figure 10: HVMs of the Empirical Study 2 - for staff and for end-users**

Upon reviewing Figures 9 and 10, some limitations of separating the maps become apparent. The division resulted in the exclusion of certain constructs and connections, such as "family experience" (a service encounter). This happens because the cut-off point requires the aggregation of perceptions from both user groups for constructs to be included. Therefore, a revised cut-off point may be needed when analysing maps separately.

The two maps reveal that the HVM from the perspective of end-users is significantly simpler than that based on service providers. This is partly due to the limited number of end-user interviews conducted. Nevertheless, service providers' responses reflect not only their own perceptions of the HBE but also what they observe from patient experiences. **This reinforces the idea that service providers' insights offer a rich source of data, which can be valuable for understanding value generation from the patient's perspective.**

Regarding the applicability of the method, it was successfully implemented in two different empirical studies, each focusing on distinct hospitals and healthcare units. This suggests that the i3 method can be used across a diversity of healthcare facility contexts. Although data collection required a significant time investment - approximately 22 hours for each empirical study (Table 2) - the method outputs can potentially offer contributions to HBE design decision-making. Moreover, repeating the application of the method for the same healthcare unit for continuous improvement is likely to streamline this process, reducing the time and effort required for data collection and analysis.

DISCUSSION

Building on Reynolds & Gutman (1988), this research proposes a framework for modelling value generation in Healthcare Built Environments (HBE), encompassing three key categories of constructs: the built environment, the service encounter, and abstract attributes. This novel distinction enhances understanding of the interplay between HBE and services, particularly at

the attribute level, as evidenced by the number of connections between service and HBE constructs, illustrated in Figures 7 and 9. The inclusion of two empirical studies in this research demonstrates the applicability of the i3 method across diverse healthcare contexts, from complex environments to simpler ones, highlighting its flexibility and adaptability.

A key contribution of this research is the differentiation between intra- and inter-level connections within the hierarchical value maps, a novel approach introduced in this study. Intra-level connections highlight the complementarity between constructs at the same level of abstraction - an aspect largely overlooked in previous research – while inter-level connections clarify relationships across attributes, consequences and values, as proposed in prior studies. This distinction improves the clarity regarding construct's role and interconnections, thereby facilitating a better understanding of value generation. For example, in Figure 7, the construct "facilitate assistance" has only intra-level connections, but it influences other constructs, such as "cosiness" and "avoid waiting time". Conversely, "continuous learning" features only inter-level connections, linking the value "achievement" with attributes like "care assistance".

Attempts to separate the HVM by user group in empirical study 2 revealed certain limitations. Service providers, due to their extensive experience within the HBE, exhibit a higher level of engagement, whereas end-users have less direct interactions with the HBE (Claeys & Abeele, 2001). This influences the number of constructs and linkages identified by each user group. Additionally, Turley and Fugate (1992) stress the importance of considering multiple perspectives without prioritising one over another. This reinforces the importance of mapping the answers of distinct groups of users jointly in HVMs.

Another key finding is the gap between the constructs identified in the HVM and the institutional values outlined in hospital strategic plans. This discrepancy may indicate a misalignment between formally defined institutional values and the operational realities, or a failure to translate these values into the built environment and service delivery. As Schwartz &

Cohn (2002) argue, strategic planning should be continuous and grounded in operational insights, ensuring frontline staff can effectively implement institutional values in daily practice. The HVMs generated by the i3 method could serve as a reference for strategic planning, helping to identify institutional values that are not being effectively addressed and require further attention to align them with user-perceived values.

The application of the method required a substantial time investment—approximately 25 hours for the investigation phase alone. However, use within the same HBE is expected to enhance the efficiency of data collection, gradually reducing the time and effort involved. It is also recommended that the method be implemented by an external facilitator, as staff members may be less comfortable expressing their views openly in the presence of colleagues.

Overall, the i3 Method has proven valuable in enhancing understanding of how HBE contribute to service provision, by revealing critical relationships between the physical environment and service encounters. It facilitated the identification of key constructs influencing value generation and offered insights into their significance. Unlike previous studies employing the MEC approach, this research explicitly considers the interaction between the HBE and healthcare services in value generation. In other contexts, such as housing, attributes of the built environment may generate value independently (Hentschke et al., 2014; Monteiro & Miron, 2018). In contrast, within healthcare settings, the built environment does not generate value in isolation, but it is intrinsically connected to service delivery (Ransolin et al., 2022). By recognising this distinction, this study addresses an important gap in the literature, integrating insights from complementary bodies of knowledge, including service encounters (Shostack, 1982) and user perceptions (Bitner, 1992).

From a practical perspective, the main contribution of this research is the potential application of HVM in healthcare design decision making. The i3 Method can inform design

choices for both refurbishment and new projects, as well as support further research by providing evidence for strategies to enhance value generation across different HBE.

At the attribute level, the HVM highlights constructs that can be modified to enhance value generation (Brito, 2015). By mapping connections between the built environment and service encounters, it enables an analysis of how design and project management decisions may impact value. For instance, in Empirical Study 1, improving the "**space for care giver**" construct could positively affect the "**family experience**" and reduce anxiety, aligning with existing literature on the role of family involvement in minimising patient stress (Dracup, 1988; Fontaine et al., 2001).

A bottom-up analysis of the HVM provides decision-makers with insights into the attributes that strongly influence higher level user values (Brito, 2015). For example, in Empirical Study 2, the user value "**motivation**" is linked to "**cosiness**", which is associated with "**environmental conditions**", such as acoustics, lighting and temperature. Enhancing these conditions could be a strategy to improve motivation – helping achieve a higher-level value.

Limitations

This study has several limitations. First, data collection was constrained by the COVID-19 pandemic in Brazil. As a result, the focus group assessment could not be conducted for the first empirical study, and the observation methods in the second study required adaptations.

Second, the participation of end-users in interviews was limited due to the stress-induced conditions of their health and the specific hospital units they were in. In the ICU, access was restricted due to the critical conditions of the patients, limiting interviews to those with medical and technical expertise (de Oliveira & Maruyama, 2009). This led to a greater emphasis on the perception of service providers, with the saturation criterion applied only to this group. End-user interviews were constrained by access limitations rather than reaching a saturation point. There were only two key clinical staff involved in the evaluation of the model's utility, and

hence a more extensive evaluation of the model is needed. Lastly, the study did not differentiate between attributes perceived as strengths or weaknesses, which could offer further insights into value generation.

CONCLUSION

The main outcome of this research study is the i3 method, which can be used to understand value generation in HBE by examining the relationships between built environment attributes and healthcare service delivery, from the perspective of multiple user groups. Rooted in the Means-End Chain (MEC) conceptual model, this method identifies and represents key constructs and their interconnections, offering a multidimensional approach to value generation.

The development of the proposed i3 method enabled the integration of distinct theoretical frameworks for modelling value generation in HBE, which is a contribution of this research. This approach facilitates the identification of previously under-recognised relationships between the built environment and healthcare services by combining multiple sources of evidence—namely observations of services and facilities, alongside interviews with a diverse range of users. Thus, it is possible to identify potential weaknesses in HBEs in adapting to changes in service provision or responding to unforeseen demands.

Furthermore, this research has identified several opportunities for future studies on value generation in HBE, which could enhance the applicability and impact of the i3 Method:

- Extending the application of the i3 Method to different healthcare facilities.
- Implementing the i3 Method to support design processes in new healthcare projects.
- Developing a visual distinction between positive and negative responses from laddering interviews to aid decision-makers in identifying improvement opportunities.

- Expanding the method by introducing a hard-laddering protocol to quantify the relative importance of constructs.

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289 **Appendix A:** Data collection instrument

	VALUE GENERATION RESEARCH	Developed in:	Modified in:	Interview number:
		Created by:	Modified in:	Interview date:
	INTERVIEW FOR END-USERS			

PRESENTATION	My name is _____, I am a researcher who is part of a team at the _____ University, which is carrying out a research study on value generation from healthcare built environments in the Paediatrics Emergency Unit, in partnership with _____ Hospital. The information from this research study will be used only for academic purposes and your identity will be preserved. It is estimated that the maximum time is 15 minutes. Your participation in the research is completely voluntary, i.e. it is not mandatory. Can I have your participation?
INTERVIEWEE PROFILE	Age range: ( ) 18 - 28 yrs ( ) 29 - 38 yrs ( ) 39 - 48 yrs ( ) 49 - 58 yrs ( ) 59 - 68 yrs ( ) 69 - 78 yrs ( ) 79 - 88 yrs ( ) more than 89 yrs
	Bond with the Paediatric patient:
HEALTHCARE BUILT ENVIRONMENT AND SERVICE	Time spent in the PEU:
	How was your journey to the Unit? ( ) Private ( ) Ambulance
	Briefly describe the service provided at the PEU: _____ _____ _____
	HBE of the PEU to which you had access: _____ _____ _____
POSITIVE SOFT-LADDERING	Given your perception of the healthcare built environment and the service provided, point out **three main positive aspects** related to the Paediatric Unit. Why?
	1.
	2.
	3.
NEG	Given your perception of the healthcare built environment and the service provided, point out **three main negative aspects** related to the Paediatric Unit. Why?

	1.
	2.
	3.
INTERVIEWEE' S GENERAL OBSERVATIONS	
INTERVIEWER' S GENERAL OBSERVATIONS	

290

291

	VALUE GENERATION RESEARCH	Developed in:	Modified in:	Interview number:
		Created by:	Modified in:	Interview date:
	INTERVIEW FOR SERVICE PROVIDER			

PRESENTATION

My name is _____, I am a researcher who is part of a team at the _____ University, in partnership with _____ Hospital, which is carrying out a research study on value generation from healthcare built environments in the Paediatrics Emergency Unit. The information from this research will be used only for academic purposes and your identity will be preserved. It is estimated that the maximum time does not exceed 15 minutes. Your participation in the research is completely voluntary, that is, it is not mandatory. Can I count on your participation?

INTERVIEWEE PROFILE

Educational background:

Age range: ( ) 18 - 28 yrs ( ) 29 - 38 yrs ( ) 39 - 48 yrs ( ) 49 - 58 yrs
( ) 59 - 68 yrs ( ) 69 - 78 yrs ( ) 79 - 88 yrs ( ) more than 89 yrs

Profession:	Years in the unit:	Work shift:

Brief description of the work routine:

HEALTHCARE BUILT ENVIRONMENT AND SERVICE

Select the HBE that are linked to the Paediatric Emergency Unit:

( ) Waiting Room	( ) Examination Room	( ) Isolation Room
( ) Reception and Registration	( ) Medication Room	( ) Service Room
( ) Toilets of Waiting Room	( ) Pyxis Area	( ) Utility Room
( ) Welcome Area	( ) Consultation Room's Toilets	( ) Cleaning Supply Room
( ) Children's Play Area	( ) Linen room	( ) Staff's Toilet
( ) Screening Room	( ) Emergency Room	( ) Staff's Break Room
( ) Administration	( ) Nursing Station	( ) On-call Room
( ) Wound Care and Suture	( ) Observation Room	( ) Other:

Do you spend a significant amount of time in any of these spaces? What percentage of your time would you estimate you spend in this space? _____

Main furniture and equipment you use: _____
_____
_____

POSITIVE SOFT-LADDERING

Given your perception of the healthcare built environment and the service provided, point out **three main positive points** related to the Paediatric Unit. Why?

1.

2.

	3.
NEGATIVE SOFT-LADDERING	Given your perception of the healthcare built environment and the service provided, point out **three main negative points** related to the Paediatric Unit. Why?
	1.
	2.
	3.
INTERVIEWEE' S GENERAL OBSERVATIONS	
INTERVIEWER' S GENERAL OBSERVATIONS	

299

300 **Appendix B:** Brief description of constructs that emerged in the two empirical studies

Level of Abstraction		Construct	Brief Description / Practical Examples
ATTRIBUTE	BUILT ENVIRONMENT	Assistance Area	The area where the main care assistance tasks take place, such as evaluation/triage, treatments a beds; nursing stations;
		Reception and Waiting	The area at the access point for welcoming end-users. Also, it is the place where users wait for waiting seats; reception desk;
		Support and Adm.	The location for administrative activities, including areas for supporting staff. e.g. offices; locker
		Décor	The style of interior decoration and furnishings. e.g. paintings; plants
		Furniture	Seating arrangements; Beds; Chairs; and Space for personal storage.
		Entertainment features	Activities or objects designed for distraction. e.g. play areas; TV
		Resources / Equipment	Equipment; internet; computer; advanced technology; information System; and uniform/apparel
		Dimension	The dimensions and spatial configuration of the built environment, designed to support and accor
		Space for Family	Suitable space for family members/companion. e.g. chair next to inpatient bed; room for meeting
	SERVICE ENCOUTER	Arrival	The first contact between user and the unit.
		Family Experience	Activities involving family members. e.g. meetings, updates and visiting hours
		Clinical Care	Patient constant care routine.
		Break	Rest pause for staff throughout the work shift
		Waiting	Waiting for assistance, for information or for patient demands.
	ABSTRACT	Environmental conditions	Air conditioning; acoustics; lighting; temperature; air quality; noise; music; odour
		Layout	Spatial organization, regarding the unit itself (e.g. furniture; integrated environments) or locatio and distance in relation to other units);
		Staff Profile	Characteristics of individual team members, including: technical skills; experience; motivation Also, some behaviours towards patients, such as: being patient and polite, being an active liste behaviour and empathy;
		Team-working	The process of staff working with co-workers collaboratively, such as: supporting other team mem among co-workers; good working atmosphere and morale
		Flexibility	Resilience and capability of the HBE to adapt to different scenarios regarding distinct uses, dema
		Family Presence	Opportunity for the family member/companion to be close to the patient along care assistance
		Workflow	Well-established sequence of tasks on the HBE, including a well-defined service schedule;
		Aesthetics	Visual attractiveness; appearance of the HBE; presentation of staff (e.g. uniforms); user-oriented

301

Level of Abstraction	Construct	Brief Description / Practical Examples
CONSEQUENCES	Proper Care	Providing good care assistance to patients, including correct diagnostic, and effective treatmen
	Global Assessment	Assessment that results from the collective knowledge and expertise of different profess physiotherapists).
	Positive Distraction	Feeling entertained and distracted;
	Avoid Anxiety/stress	Minimizing stressful situations during clinical care, reducing patient anxiety and burnout an calming and relaxing atmosphere.
	Avoid Risks	Preventing illnesses and any situation that may jeopardize health conditions; Acting on infecti
	Avoid Waiting Time	Minimizing delays and long waiting times, preventing overcrowding of patients and compa scheduled appointments;
	Communication	Service-oriented interaction, including open dialogue and clear communication among service workers, as well as team discussions.
	Ergonomics	Working conditions that improve effectiveness for staff, such as adequate lightning and layou conditions for human activities
	Facilitate assistance	Actions that contribute to facilitate care assistance, such as parents/family member who co distraction and trust
	Cosiness	A sense of comfort in a pleasant and welcoming environment; Having a hospitable treatment
	Focus	Staff being able to keep full attention to work
	Empathy	A sense of being cared for (not only for patients, but also family members and staff) throug understood and taken seriously
	Privacy	Being able to keep personal matters private and being free from other people's observation, he
	Resting moments	Opportunities for staff to rest, unwind and recharge for the following shift; Time for the pati care assistance, for example, while the patient is being medicated.
	Trust and Safety	Condition of being in a safe environment, or being protected with safe working conditions. Als other people
	Comprehension	Being able to understand the situation
	Easy Access	Easy connection to other units; Not being difficult to find another environment
	Visibility	Visual connection in the environment, so staff is able to have an overview of the unit
	Avoid Conflicts	Proactive measures to prevent interpersonal issues, allowing staff to focus on tasks in tense o patients and families.
	Continuous Learning	Staying up to date continuously
	Staff Integration	Interpersonal relationships and social interactions among staff members, independently of wor
	Space Adequacy	Adequate space to accommodate planned activities; Work-as-Imagined (WAI)

Level of Abstraction		Construct	Brief Description / Practical Examples
VALUE	USERS' VALUES	Well-being	Condition characterized by pleasant feelings
		Therapeutic Success	Patient got well, recovered from illness;
		Satisfaction	The fulfilment of user expectations
		Achievement	A sense of professional accomplishment through effort or skill
		Motivation	A sense of motivation; willingness to work
		Trustworthy service	Having credibility on the institution, service; possible end-user return or recommendation

Level of Abstraction	Construct	Brief Description / Practical Examples

HOSPITALS' INSTITUTIONAL VALUES	Technical Skills	Continuous improvement to enhance service excellence and agility.
	Teamwork	Cohesive and integrated participation of all hospital employees.
	Excellence	Seeking for excellence in everything the hospital does.
	Focus on Results	Working to get the best results in everything the hospital does.
	Quality and Safety	Processes are carried out with a focus on quality and safety.
	Union and Collaboration	Working in an integrated and collaborative way, based on the understanding that the hospita

LEGEND

✓	construct mentioned more than 4 times
x	construct mentioned 3 times or less, being consequently disregarded
n/a	construct does not apply

311