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RESEARCH ARTICLE

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Eight caring technology principles: development and implementation of a framework for responsible health technology innovation

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ABSTRACT

Successfully implementing care technology to enhance people's health-related quality of life poses several challenges. Although many technological tools are available, we lack consensus on values and principles, regulatory systems, and quality labels. This article describes the FIDE process of the Belgian 'Teckno 2030' project: Future-thinking Interdisciplinary workshops for the Development of Effectiveness principles, resulting in a framework of eight Caring Technology principles. These principles are built on three overarching values: autonomy, justice, and trust. The framework enables responsible health technology innovation by focusing on the needs of users and society, data security, equity, participatory governance, and quality control. A learning community was established to support the framework's implementation in projects, organizations, and the broader innovation community. We also discuss the barriers, facilitators, and practical tools developed within this learning community. The FIDE process, caring technology principles, and learning community provide a case study for responsible innovation in care technology.

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Introduction

In 2018, the Dr Daniël De Coninck Fund, managed by the King Baudouin Foundation, presented a call for project funding to support the implementation of caring technology at home in Belgium. The King Baudouin Foundation is a philanthropic organization based in Belgium with activities worldwide aimed at empowering organizations and citizens working together to create a better society (King Baudouin Foundation 2023a). The Dr Daniël De Coninck Fund focuses on improving the health and quality of life of people who need care and support in their home situation: it invests in *accessible, high-quality, humane primary care* (King Baudouin Foundation 2023b). The Fund had identified a divide between a vast array of available technological applications on the one hand and their actual successful implementation in the setting of the patient's home on the other hand. Therefore, they launched a call to support projects that focused on implementing technology in the home environment aimed at actively improving the quality of care. The call received a response of 58 submissions from diverse settings, including home care organizations, universities, patient and carer associations, and regional hospitals implementing new or existing technological tools. They proved difficult to assess. The Foundation and the experts involved in judging the projects noted a strongly fragmented innovation field (where similar projects happened in different places unaware of each other's existence), and within the projects, a general lack of communication strategies, business plans, and upscaling methods (Daems 2023). One of the co-authors (WD) analyzed the encountered issues and summarized them in Table 1.

This led to the conclusion that a framework was missing, not only to support the jury in assessing the quality and effectiveness of these multi-faceted projects but also to guide organizations in developing and implementing health technologies. Such a framework would need to identify underlying shared values and principles and concrete goals and criteria that project managers, IT developers, healthcare providers, carers, and patients can apply in real-life settings. This is not a new idea or question: the past two decades have seen the development of many different frameworks aimed at ethical and responsible technology development and assessment (Assasi et al. 2014; Bellemare et al. 2018; Hofmann et al. 2015; Jobin, Ienca, and Vayena 2019; Krahn et al. 2020; Pacifico Silva et al. 2018; Palm and Hansson 2006; Vandemeulebroucke et al. 2022; Winkler and Spiekermann 2021). Ethical technology assessment (eTA), value-sensitive design (VSD), and responsible research and innovation (RRI) are probably the most widely used

Table 1. Limitations of the project proposals in the King Baudouin funding call.

Limitation blindness	• More focused on the problem than on finding solutions • Insufficiently multi-faceted/ multi-stakeholder approach • Lack of insight into the limited expertise of the team
Insular thinking	• Not well integrated into the broader pathology scene or existing care chain • No drive for collaboration, communication, and outreach during the development
Innovation immaturity	• Insufficient technology-development skills/experience • Insufficient impact generation skills/experience • Insufficient project management skills/experience
Business immaturity	• Insufficient business-development skills/experience regarding budget effectiveness, scalability, penetration, sustainability • Lacking pragmatism to pursue system integration solutions rather than bottom-up development

(Vandemeulebroucke et al. 2022). However, even though we have several frameworks available, there is still a lack of consensus on which values should guide the evaluation processes and how these frameworks should be implemented (Bellemare et al. 2018; Bleher and Braun 2023; Jacobs and Huldtgren 2021; Keenan et al. 2021; Lehoux et al. 2023). Most frameworks use the traditional medical ethics principles of autonomy, beneficence, non-maleficence, and justice as a backbone, but it is unclear whether these principles are as useful in a health technology context (Mittelstadt 2019). Checklists suggesting an ethical analysis of new health technologies based on crucial ethical aspects or domains, such as eTA, have been criticized for focusing too much on negative effects and for potentially missing ethical challenges that arise with new technologies that fall outside of the predefined domains (Kiran, Oudshoorn, and Verbeek 2015). Principles-based frameworks are usually created top-down, meaning they do not build on stakeholder co-creation or engagement to construct the list of principles. Moreover, it is unclear how a list of principles should be implemented in real-life care technology design and implementation settings. VSD seeks to improve the design process and its outcomes via stakeholder engagement, using a tripartite, iterative methodology to support human values (Friedman and Kahn 2002; Winkler and Spiekermann 2021). Although VSD incorporates stakeholders' voices and may be well-equipped to identify ethical values and conflicts, it is less able to set priorities and make normative decisions due to its lack of commitment to an ethical theory (Jacobs and Huldtgren 2021). RRI faces similar criticisms: although it has a strong focus on stakeholder engagement to ensure science and innovation take the needs of society into account (i.e. social responsibility), the approach was mainly developed from top-down research funding institutions and lacks alignment with a normative ethics framework (Boenink and Kudina 2020; Ryan and Blok 2023). This means fundamental questions still need to be answered: what mutually agreed-on values and principles should drive technological health innovation, specifically in the home care setting? How do we implement these principles into technology development and use? What support systems should be in place to ensure responsible innovation processes and enable the evaluation of existing care technologies? These questions are internationally relevant. Both the literature and our experience with the project proposals identified the need to develop a principles-based framework through stakeholder involvement that may be integrated at the different levels of technology development, implementation, and use.

Considering the broader international context and the Belgian community care context, the Dr. Daniël De Coninck Fund set out to support the development of a framework that could answer these questions based on engagement with experts. They assembled stakeholders from various backgrounds who all contributed to a co-creation exercise in the 'Teckno 2030 project' (King Baudouin Foundation 2020). The project resulted in the development of eight caring technology principles (CTPs) through future-thinking, interdisciplinary workshops. This article will present the process, the framework of 8 principles, and the learning community working on their implementation. We want to share our experience with an international audience for two reasons. First, the 8 CTPs framework may prove valuable to other organizations and countries facing the challenge of responsible technology development in healthcare. Second, the FIDE process (see below) we used to develop this framework may inspire others to use a similar method in their

journey, as we acknowledge that principles for responsible technology development may need to be tailored to specific contexts, cultures, and countries. This article, therefore, also invites reflection on the integration of ethics in frameworks and guidelines for technology development and implementation.

Method

FIDE process

The project brought a group of diverse stakeholders around the table to develop guiding principles using a method of future exploration or future thinking (Kristóf and Nováky 2023). We coined this with the acronym FIDE: Future-thinking Interdisciplinary workshops for the Development of Effectiveness principles. We will describe the participants, definitions and goals, workshop process, underlying principles-focused developmental evaluation method, and the establishment of the learning community. This process builds on Patton's principles-focused evaluation method and largely follows the four practical steps for creating effectiveness principles in healthcare as set out by Iyamu et al. (2021), with the addition of building a learning community around the principles (Iyamu et al. 2021; Patton 2018). Figure 1 shows an overview of the FIDE process, and the five steps are also summarized in Supplementary File 1.

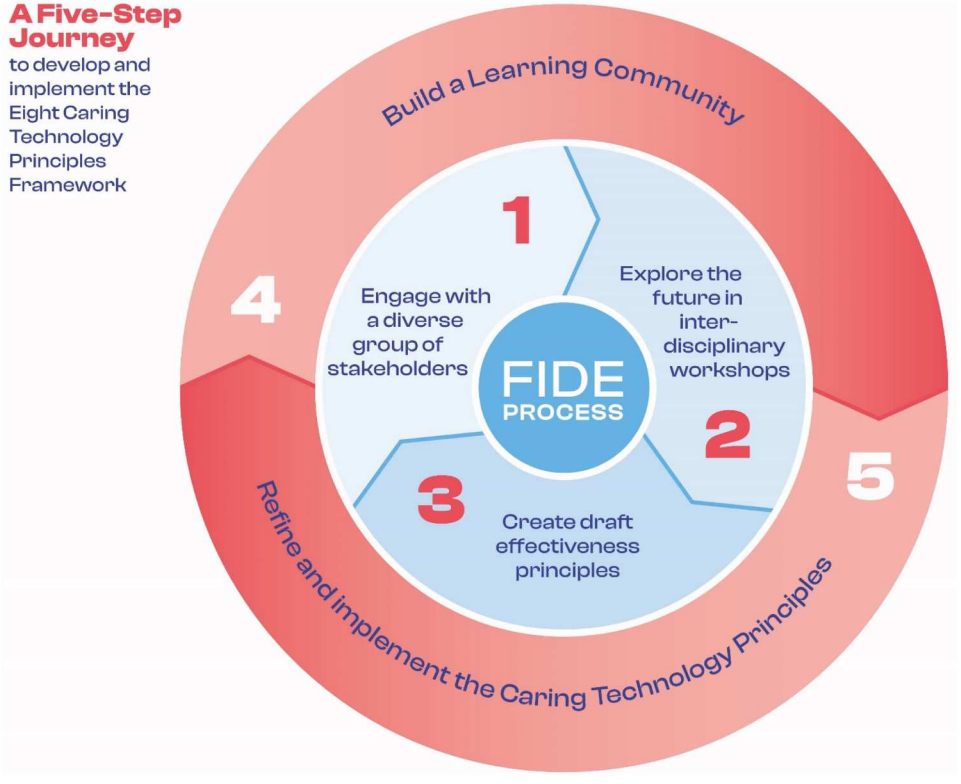

Figure 1. Overview of the FIDE process.

Participants

A total of 26 participants and six support staff were actively involved in the project. Eleven participants were native Flemish speakers, the others French – interpreters facilitated interactions where needed. The participants had diverse profiles: about a third had an academic background related to technology, healthcare, or ethics; another third represented healthcare professions and organizations, such as home and community health associations; the final third consisted of innovation managers, technology developers, communication specialists, and patient group representatives. Some participants combined different roles. All participants spoke for themselves, not on behalf of the organizations they worked for. The reflection group respected the Chatham House rule, i.e. they were free to use the information they received without revealing other participants' identities (Chatham House 2023). Out-of-the-box thinking was encouraged: with a future-thinking focus in the workshops, participants were asked to imagine alternative outcomes of successful technology integration in community-based care beyond existing limitations and restrictions.

Definitions and goals

The project set out with four concrete goals:

(1) Explore the potential of technology to enhance people's health-related quality of life in their daily lives.
(2) Discuss the impact of health-related technologies on stakeholders in various contexts and, more specifically, future scenarios.
(3) Identify leverage points and essential conditions to ensure technology and data use improve health-related quality of life.
(4) Develop guiding principles to direct and inspire actions, initiatives, technology development, and data use towards improving people's health-related quality of life.

These goals formed the backbone of the workshops organized by the stakeholder group. The first brainstorming session introduced the project and participants and sought a common understanding of the central concepts and ideas. All concepts of the first goal, i.e. to explore the potential of *technology* to enhance *people*'s *health-related quality of life* in their *daily lives*, were defined in this first session. To start with, 'technology' was defined broadly, encompassing a wide variety of health-related technologies: artificial intelligence, robots, mobile health, internet of things, genomics, and 3D-printing, to name a few (Raeymaekers, LyRaGen, and Mathy 2020). The group consciously chose to include a broad range of technologies to avoid the development of a framework that would be too narrow or rigid, hoping to create flexible, future-proof principles. Second, the 'health-related quality of life' concept was based on the WHO's questionnaire for assessing the subjective quality of life in healthcare settings (WHO Quality of Life Assessment Group 1996). It defines quality of life as a multidimensional concept consisting of six domains and facets that all play a role in a person's well-being: physical, psychological, level of independence, social relationships, environment, and spiritual (WHO Quality of Life Assessment Group 1996). During the workshops, the participants used this multidimensional concept of health and quality of life. Lastly, the setting 'daily lives' was

chosen to emphasize that the place of care should not be limited to the home environment but could also include a place of work, school, recreation, the community, and healthcare systems. In this sense, 'daily life' refers to people's habitat or ecosystem. The term 'patient' was avoided for similar reasons: the project aimed to include many different users and non-users of technologies who do not necessarily identify as patients. 'Citizens' was used as a more appropriate and inclusive term.

The process

The process consisted of four workshops held between July 2019 and March 2020, with about twenty participants attending the meetings on each occasion. All workshops were facilitated by a dedicated expert consultant who brought extensive experience in this area, and findings were written into reports by two consultants, one in Flemish and one in French (Raeymaekers, LyRaGen, and Mathy 2020).

The first workshop was a *brainstorming meeting to determine the project's scope and goals* and get to know the participants involved, as described above.

The second workshop lasted two days and explored possible futures (Kristóf and Nováky 2023). Future thinking embraces complexity and uncertainty: it builds scenarios by investigating how key uncertainties may interact to generate alternative, plausible futures in a non-normative manner. However, it cannot be proven that they are 'true' or 'correct'. The relevant question is how we would react and what strategies we would develop if one of these plausible alternative futures materialized (Raeymaekers, LyRaGen, and Mathy 2020). The participants first identified external factors and driving forces expected to play a role in the future use of technology and data for people's health-related quality of life. From ten themes, two were chosen as key uncertainties: the degree of active involvement and engagement of citizens and the degree to which common interests are pursued. This does not mean the other identified themes were discarded; rather, the two key uncertainties allowed for a focused discussion and effective brainstorming sessions in smaller groups. These two tensions (passive vs. active citizens, individualism and corporatism vs. the common good) created four future worlds, and participants worked in small groups to describe what health technology implementation would look like in 2030 in each worldview (see Figure 2). They identified strengths, weaknesses, opportunities, and risks in each future world, building on the key uncertainties without focusing on personal preferences.

This process was facilitated by ten personas or use-case scenarios inspired by the European Blueprint project but adapted to the local context (European Commission 2016). The participants imagined the consequences for selected personas living in their future world: would they thrive or struggle? To what extent is technology transparent or a black box, and how is data ownership understood? Regulation, governance, financial structures, and ethical challenges were all discussed within each worldview. In this sense, the second workshop was a thought experiment to explore the mutual impact of health technology on stakeholders and society.

The third workshop consolidated the work on the four worldviews and sought to identify leverage points and essential conditions across the four worldviews. These common leverage points (or places where interventions could create the most significant impact) and essential conditions (i.e. what is needed to reach set goals) were then described at five levels: the individual user, relationships, stakeholder organizations,

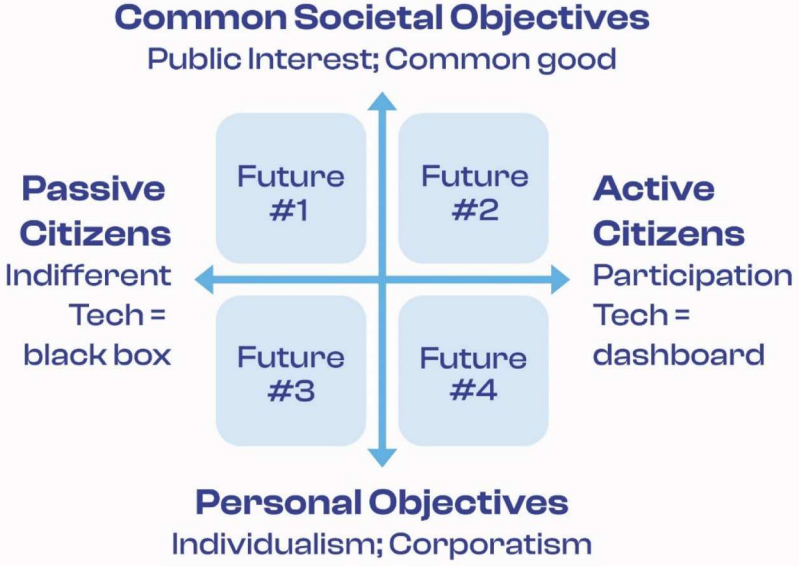

Figure 2. Overview of the four future worlds based on the selected key uncertainties.

systems, and policy and government. The list of leverage points and essential conditions formed the basis for the further development of the principles.

The final workshop held in March 2020 built on the identified leverage points and conditions to draft a framework of 8 guiding principles. The participants consolidated the material from the previous workshops into eight themes: (1) person-centered technology, (2) collaboration, (3) accessible information and informed consent, (4) empowerment, literacy, and active participation, (5) building trust through data ownership and stewardship, (6) quality assessment systems, (7) flexibility and evolution, adaptive governance, and (8) sustainability. These themes contained insights, examples, and references, which were then translated into effectiveness principles. These principles had to meet the GUIDE criteria stipulated in Principles-Focused Evaluation (see below): they needed to inform, inspire, and guide interventions to improve technology users' health-related quality of life (Patton 2018).

Guiding principles: principles-focused evaluation

Principles-focused evaluation (PFE) stems from developmental evaluation methods seeking to evaluate innovations in complex, dynamic environments (Patton 2018). PFE uses *effectiveness principles*: statements that provide 'guidance about how to think or behave toward some desired result (either explicit or implicit), based on norms, values, beliefs, experience, and knowledge' (Patton 2018). PFE emphasizes a collaborative, interactive, and utilization-focused process (Iyamu et al. 2021; Patton 2018). There are five criteria to ensure high-quality effectiveness principles, summarized in the acronym GUIDE: they need to be guiding, useful, inspiring, developmental, and evaluable (Patton 2018). These criteria informed the formulation of the eight principles in the final workshop and the subsequent writing process.

Learning community

Upon completion of the draft effectiveness principles, a learning community (LC) was established to facilitate the implementation of the 8 CTPs in the design and development of new and existing technologies. Initially, the LC consisted of workshop participants, but it was opened up to include others representing patient organizations, care professionals, innovation managers, industry partners, and academics.

The LC was mainly concerned with the integration of the 8 CTPs into policy and healthcare innovation, and with ensuring the principles were accessible to all potential stakeholders involved in care technology, including patients and care professionals.

In the first step (April 2021), spearheads were designed to establish priorities and to give the 8 CTPs more visibility, resulting in 5 concrete goals: develop activities and the learning community; make the 8 CTPs more concrete; incentivize actors; create enabling conditions; and internationalize activities. These spearheads guided a project call on invitation by the King Baudouin Foundation. Six projects were selected (November 2021) to develop an action plan and concrete tools for the adoption of 8 CTPs and to support stakeholders in integrating the principles into their organizations' innovation processes. The projects did not exist in isolation but exchanged experiences and materials, shared opportunities and pitfalls, and learned from each other as their projects evolved. Therefore, the main pillars of the LC were co-creation, critical reflection, joint actions, and sharing best practices. As the LC grew, the need arose for more coordination and a cross-project action plan.

Due to the COVID-19 pandemic, there was a delay between the start of the six projects and the coordination by the LC. This resulted in the individual projects creating slightly different interpretations of the 8 CTPs for their target groups. Once these different versions were identified, a dedicated group from within the LC held several meetings to reach a consensus on the 8 CTPs formulation, discussing each CTP in detail and going through multiple rounds of revision (July-September 2023). This iterative process led to the final version of the 8 CTPs framework, as presented below.

Results

8 caring technology principles

The FIDE process and the work of the LC on the principles led to the final version of the 8 CTPs (see Table 2). These were published on the website of the Dr. Daniël De Coninck Fund ('Eight Guiding Principles for Caring Technology' 2020). The principles are organized along four themes: promoting a humane approach in technology and data management, supporting societal anchoring, stimulating participatory governance, and monitoring quality and societal impact. Additional information on the 8 CTPs is available in Supplementary file 2.

These eight principles do not sit in isolation: there is a high degree of interrelation between them, as shown in Figure 3 below. Overarching values are *autonomy, justice, and trust*. Placing the user in a central position is captured in several principles, from identifying and supporting their needs (principle 1) through ensuring informed consent (principle 3) and data stewardship (principle 4) to emphasizing active participation in technological governance (principle 6). Avoiding siloed principles allows for a richer, multifaceted exploration of technologies and their interaction with different

Table 2. 8 Caring Technology Principles Framework.

THEME 1 PROMOTE A HUMANE APPROACH IN TECHNOLOGY AND DATA MANAGEMENT	
Principle 1. Support users' needs and autonomy	Ensure that technology and data meet the needs of the users and serve people and society. Engage individuals and communities to gain insights into their care needs and health-related goals. Technology and the use of data should always support users to make their own autonomous decisions.
Principle 2. Establish participation through integration	Establish ongoing collaboration among all stakeholders through the creation of an integrated ecosystem encompassing people and technologies. This can be realized by setting up interoperable technologies using standardized protocols and open-source formats. Support patients and citizens to participate fully in the development and use of this ecosystem.
Principle 3. Obtain true informed consent	Empower people so that they are able to make choices in a truly informed and independent way. Provide reliable, transparent, comprehensible, and accessible information about caring technologies. Disclose the practical advantages and disadvantages objectively to ensure users feel confident about the technologies they choose.
THEME 2 SUPPORT SOCIETAL ANCHORING	
Principle 4. Use data safely for personal health and public interest	Strengthen trust between people and organizations when using data and technologies. Allow citizens to control and manage their personal data or to delegate the management to a third party of their choice. Assist them in sharing and using their data safely to improve their personal health and well-being and to serve the public interest.
Principle 5. Reduce digital and health inequities	Improve technological skills and health literacy and commit to lifelong learning for all. Engage everyone to participate, including the vulnerable and disadvantaged, so that no one is left behind. Focus on reducing digital and health inequities, do not contribute to them.
THEME 3 STIMULATE PARTICIPATORY GOVERNANCE	
Principle 6 Create participatory governance	Create participatory and adaptive governance for the caring technology ecosystem. Encourage citizens and stakeholders to participate actively in decision-making processes. Adjust policies based on data analysis, new evidence, experience, and growing expertise, making sure they remain effective and responsive to evolving needs.
THEME 4 MONITOR QUALITY AND SOCIETAL IMPACT	
Principle 7 Implement quality assurance and control	Implement quality assurance systems for the entire process of innovation. Continuously evaluate the development and use of data and technology. Quality control should include content, privacy, security, transparency, traceability, interoperability, effectiveness, and inclusiveness. Knowledge should be built on both experience and scientific evidence. Introduce quality labels to disseminate the evaluation results and make them easily accessible to users.
Principle 8 Align innovation with wider societal frameworks	Monitor and evaluate the caring technology ecosystem for its impact on society within wider frameworks of health, democracy, prevention, ethics, and sustainability. Ensure technology aligns with fundamental international and democratic principles. Integrate a focus on prevention, ethical values, and sustainability objectives into the development of innovations.

stakeholders. It also means it requires work to analyze new or existing projects with this framework: stepping away from a 'tick-the-box' exercise, the framework aims to continuously encourage developers and implementers to review how the end product can be improved based on these values.

Learning community

For the past three years, the LC has been working on facilitating the integration of the 8 CTPs framework into policy and care innovation and on translating the principles to

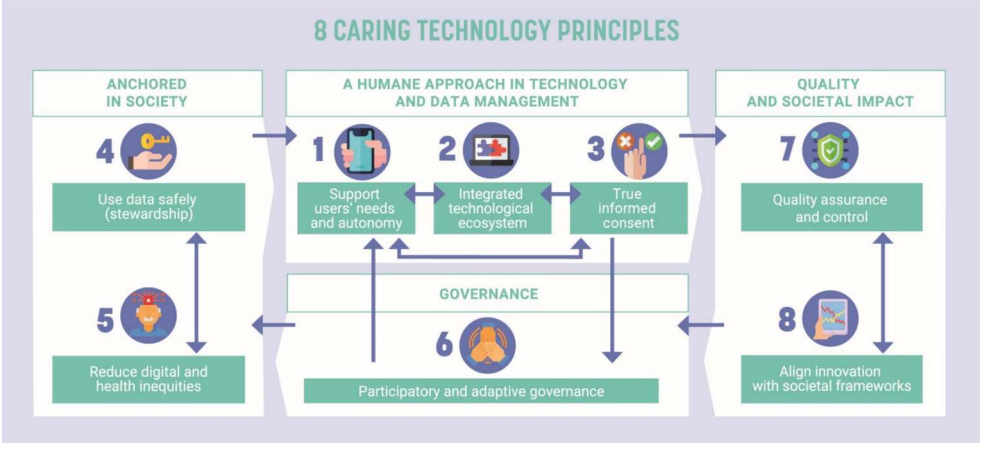

Figure 3. Interrelatedness of the 8 CTPs.

make them more accessible to all stakeholders, including patients and citizens. The current priorities of the LC are (1) to provide a clear value proposition for each of the stakeholders, (2) to develop hands-on tools to bring the 8CTPs into practice, (3) to identify and describe use cases relevant to different stakeholder groups that show how to integrate certain principles in real-life situations. These priorities have been selected to tackle the challenges that still hinder the widespread integration of the eight principles. The LC encounters barriers related to the practical application of the principles, community building, and sustainability, and has worked on overcoming these in several different projects.

Practical application of the principles

Facilitating the integration of the 8 CTPs framework into the care technology ecosystem and existing design and development processes proves to be difficult. Care technology stakeholders struggle with the complexity of the 8 CTPs and perceive them as very conceptual. When presenting the framework, the LC noted that it was challenging to explain the principles clearly and concisely and that potential partners sought more of a 'ready-to-go' approach that would allow for an easy, burden-free application into their processes, which the framework did not offer. The framework's strength of presenting complex, interrelated, developmental, and action-oriented principles, thus inviting stakeholders to engage in rich, in-depth discussions, is, at the same time, its weakness, as it requires time, effort, and a willingness to change the proposed designs or procedures. Moreover, it is challenging to define a clear value proposition for these care technology stakeholders: why should they put the time and effort into integrating the 8 CTPs into their innovation cycle or care processes? What is the added value or benefit? The LC has worked to overcome these challenges, and this process is still ongoing. First, several iterative exercises within the LC have helped to identify clear incentives for care technology stakeholders (and policymakers and investors) to adopt the 8 CTPs, such as increasing consumer trust, a better chance for a good market fit, shorter iteration processes, and fewer post-release ethical and other issues. However, convincing stakeholders of these benefits is a long process and requires evidence of effectiveness, which

has not yet been fully developed. As such, policymakers and investors are still underrepresented in the LC, and improving this engagement is an ongoing effort. Second, the LC is currently co-creating tools for citizens, patients, care professionals, care organizations, innovation managers, tech developers, and students to create awareness of the 8 CTPs and to enable such stakeholders to conduct a self-assessment and address shortcomings in designing, implementing, and evaluating care technology. One example is the development of an assessment and scoring tool based on the 8 CTPs that can be easily integrated into technology design processes. Third, the LC is working on translating the framework into laypeople's terms to ensure that its use is not restricted to healthcare professionals, innovation managers, and IT developers but reaches citizens and patients as well. A Belgian Center for Plain Language (Wablieft) is providing support with this work.

Community building

We adopted a participatory, interdisciplinary approach from the start of the FIDE process and 8 CTPs journey. While this brings a broad and rich set of knowledge, skills, and perspectives to the LC, coordinating such a diverse community and finding ways to facilitate collaboration across different groups is more challenging. It is still uncommon to bring diverse stakeholders of the care technology ecosystem together to focus on ethical considerations despite the encouragement to do so in several established frameworks. We notice that the collaborative work in the LC adds value for all involved partners, as it encourages everyone to look at questions and problems from different angles and integrates various types of expertise. However, having many participants of different backgrounds around the table also means that knowledge and content creation may slow down. The LC tries to balance a relatively fast pace on the one hand, aimed at keeping up with the innovation ecosystem and showing potential partners the benefits of engaging with the community and framework, and maintaining a co-creation dynamic on the other hand, ensuring thoughtful and inclusive processes that are open to all stakeholders. The complex governance systems in Belgium, in addition to its three official languages, have further complicated the community-building and communication strategy of the LC. Through a phased communication plan about 8 CTPs-related events and achieved milestones, an interactive discussion platform, and a dedicated website, the LC plans to engage more people in the coming year to subscribe to, adopt, and implement the 8 CTPs framework. The website (under construction: caringtechnology.be) will present the eleven currently funded LC projects, the tools being developed, and practical use cases to inspire potential partners and stakeholders.

Sustainability of the LC

The King Baudouin Foundation has provided financial and logistical support for the FIDE process and the consequent establishment of the LC. The Foundation's funding of the initial six projects allowed tailored tools to be developed, tested, and evaluated. It has facilitated the community-building efforts that have been pivotal in bringing the LC to its current maturity level. It continues to support the 8 CTPs integration through the communication strategy and by promoting the website (caringtechnology.be). However, the LC aims to become self-sufficient: partners need to take ownership and agree on a participatory governance structure for the future. The transfer to a new model and work of 'future-proofing' the LC will occur in the next few months.

Successful outcomes

The first successful outcome of this work was a joint workshop with the Belgian Knowledge Centre for Healthcare (KCE) to explore the potential use of the 8 CTPs in mobile health (mHealth) reimbursement. In September 2022, this resulted in the integration of the 8 CTPs into the final report presenting recommendations for mHealth reimbursement to the Belgian government.

Secondly, the LC has supported a comprehensive evaluation of a mobile health application for patients with multiple sclerosis using the 8 CTPs framework, resulting in an action plan to improve the application further and align it with the principles. The application had just been launched in app stores when the review was conducted. The review covered the entire project dynamics, existing collaborations, and the current state of the mobile application. One of the identified key priority actions was the need to implement a participatory governance model that includes various health professionals and patients. This has led to a further project examining how participatory governance can best be organized in health technology design and development.

Discussion

This article describes the establishment of a framework of 8 CTPs built on the FIDE process and the work of the LC. It provides eight guiding principles that encourage responsible health technology design, implementation, and assessment.

Strengths

As mentioned above, several other frameworks have been developed to screen health technology innovations (Bleher and Braun 2023; Pacifico Silva et al. 2018; Vandemeulebroucke et al. 2022). The FIDE process may help overcome some of the challenges these existing frameworks encounter. First, bringing *an interdisciplinary stakeholder group* together to engage in future exploration exercises incorporates a collaborative and bottom-up approach to establishing the framework. Second, using *effectiveness principles* seeks to bridge higher-order values and their practical application. The resulting principles are action-oriented but, at the same time, encourage discussion and rich thinking about their application and interactions. Third, there is an emphasis on *citizen engagement* throughout the framework, both in participatory governance and in the consideration of a technological ecosystem, acknowledging how people and technologies are intertwined. Fourth, the framework aims to be *accessible* to a broader group of users. The LC is currently working on translating the principles into plain language to ensure its use also reaches citizens. Lastly, the framework is *flexible* because it can be adapted and translated to fit the needs of different stakeholder groups. This does not open the door to limitless deviation from the current framework, but it does mean there is room for growth and evolution of the principles with the consensus of the LC. Here, it is also interesting to note the strong resemblance between the 8 CTPs framework and the Principles for Digital Development, which were endorsed by a wide community of international organizations (‘Principles for Digital Development’ 2024).

Reflection on the project call

Reconsidering the project call that was the direct cause for developing the 8CTPs, an obvious question emerges: Could the framework have helped mitigate the problems related to the call and listed in the introduction? On the one hand, as detailed in the report considering the project call against the 8 CTPs framework (Daems 2023), the 8CTPs cover the nine criteria of the original project call. In that sense, they don't fall short. Furthermore, the 8 CTPs framework moves beyond the initial call, for example, by (1) activating all stakeholders to take responsibility for the problems and the targeted solutions, (2) striving for technological literacy and informed consent, (3) creating trust by ensuring safe data use and participatory governance and (4) adapting policies based on experience, evidence, and expertise. On the other hand, one could argue that the critical problems in the original call related to insular thinking and fragmented innovation are not directly addressed by the framework. However, within the LC, we observed that most stakeholders who apply the 8 CTPs to their projects note the depth of the framework and interrelatedness of the principles. The stakeholders realize that a small and often uniform group of designers cannot cover all aspects of the eight principles; instead, it calls for diversity, i.e. gathering a broad group of experts, users, and non-users around the project table. Thus, a consequence of applying the framework to a project is that its requirements make it much more challenging to uphold insular thinking. Collaboration between diverse stakeholders within an integrated ecosystem is required to apply the framework successfully. This again emphasizes the importance of participatory governance and the LC for the framework.

Reflection on the LC

The establishment and work of the LC present a unique approach to facilitating the adoption and implementation of the 8CTPs. A growing number of partner organizations are exposed to the 8 CTPs, triggered by the enthusiasm of the early adopters, to explore what the added value can be for them. The participation of diverse stakeholders in the LC brings new insights and perspectives and encourages a more holistic approach. Amidst the many ethical frameworks currently emerging in the literature, it is clear that an LC is indispensable to translate values and principles into action or bring the framework to life. Particularly in the field of AI, it has been argued that 'what is currently insufficient is not the development of regulatory systems but their implementation' (Ienca 2023). Supporting early adopters and ambassadors, developing practical tools in co-creation, and ensuring that stakeholders see added value in joining the LC and integrating the 8 CTPs prevents the framework from being confined to the conceptual level, having little practical value or impact. However, even with a vibrant LC, it remains challenging to integrate the 8 CTPs into the core processes of the stakeholders, as described in the results. We did not anticipate that it would be such a challenge.

Two observations are worth noting here. From the early trials of framework application in care technology innovation, it was clear that designers and developers wanted a checklist, i.e. a tool or process that could relatively easily be integrated into existing innovation cycles and procedures. The 8 CTPs framework aimed to do the opposite: allow for a rich and in-depth exploration of design ideas and existing technologies that may require substantial

changes to existing processes, prototypes, or established applications. The question then became whether we could develop an assessment tool that would still allow an in-depth review. The LC is now working on translating the principles into an assessment and scoring tool, which is in the testing phase, to meet the needs of designers and developers seeking to incorporate the framework into existing processes while avoiding the framework being reduced to a 'tick-the-box' exercise. Secondly, LC ambassadors promoting the adoption of the 8 CTPs framework encountered opposition from designers, developers, and innovation managers because of a perceived lack of short-term return on investment (ROI). Despite healthcare systems struggling to meet increasing demand, bumping against their limits, and a large part of the population missing out on the potential benefits of health technology innovation due to literacy and financial limitations, among others, there is no clear sense of urgency among innovators to transition to the development of caring technology that can improve health, wellbeing, and quality of life for all. With the rise of AI applications over the last two years and the ethical risks and challenges they present, the integration of ethics in technological innovation has undoubtedly become a topic of conversation. However, it has not yet been substantiated in actual and practical methods of ethics integration. We see an analogy with sustainability. Companies are increasingly integrating a sustainability assessment into their innovation cycle, driven by urgency and consumer demand. Looking back at the process and efforts it took to arrive at this point regarding sustainability, it may still take a while before a similar integration of ethics becomes standard practice.

Limitations

Several limitations are worth mentioning, mainly regarding the participants in the FIDE process, the nature of the framework, the impact of the COVID-19 pandemic, and the rise of generative AI. First, the representation of the technology sector could have been higher if more actual technology developers had been involved in the workshops. We also note a lack of diversity in the expert group, as most participants could be described as highly educated, privileged, and white. Policymakers were not included in the stakeholder group, meaning their perspective was not included in the final framework. Although this was a clear limitation, there was a benefit to this because participants did not feel restricted towards policymakers in the brainstorming future-thinking sessions. While patient advocacy representatives were present, there was no direct involvement of users, i.e. patients or citizens, in the project. However, the LC collaborates with citizens to translate the 8 CTPs into a meaningful tool through iterative workshops, whereby the principles are made concrete and linked to their daily reality. As mentioned above, the LC is also working on translating the principles into plain language, making them more accessible to a broader group of users.

The 8 CTPs framework consists of interrelated principles as described above. This may make it less accessible for those seeking a straightforward checklist. Instead, the framework functions best as a guidance document to help shape new technologies and existing projects in a way that aligns with mutually shared values and supports autonomy, equity, justice, and trust.

The development of this project started before the COVID-19 pandemic, and implementation of the framework, including the establishment of the learning community, has seen delays during the height of the pandemic. The new wave of generative AI

came a few years after the 8 CTPs had been established, which means this type of technology was not a fundamental part of the thinking during the FIDE process. However, with the development of new technology, there is always a certain degree of uncertainty about which new methods may arise and how they may affect us on an individual and societal level. We believe the 8 CTPs framework is sufficiently inclusive and flexible to deal with the challenges new technologies such as generative AI may bring.

Conclusion

This article describes the FIDE process that brought stakeholders from different backgrounds together in future-thinking, interdisciplinary workshops, as well as the resulting framework of 8 CTPs and the LC aiming to facilitate the framework's integration into policy, care technology design and implementation, and citizens' daily lives. The eight guiding principles ensure responsible health technology innovation through prioritization of the needs of users and society, data security, equity, participatory governance, and quality assurance and control. The FIDE process, resulting framework, and learning community provide a case study for responsible innovation in care technology and invite reflection on the integration of ethics in frameworks and guidelines for technology development and implementation.

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