# Global developers' insights into Child Rights by Design

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May 2025

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# Executive summary

Societies worldwide anticipate the benefits of digital innovation in terms of economic growth. Although children have much to gain from digital innovation, their needs and rights are rarely business priorities. In contribution to UNDP's 2025 Human Development Report's exploration of AI's impact on people in their different life stages, this report examines possibilities to turn this tide – changing businesses' priorities towards children's rights.

In this report, we interview developers of digital products and services used by children, focusing on those working in the global South. The aim was to find out whether they are familiar with children's rights, as well as their interest and incentives to address these rights in product design, and the barriers they face. Combining the interviews with desk research and a literature review, the findings reveal piecemeal and partial attention to children's rights.

While some developers are already taking children's needs into account, most of those interviewed were unfamiliar with children's rights and the available resources that could guide them. This is most evident in the disparity between the capacity of developers within and outside Europe to design products that respect children's rights. Further, although developers often recognise the value of child protection, they tend to be less familiar with and largely unguided regarding children's other rights, especially when privacy or safety regulations or child rights policies are inadequate.

Market conditions matter. On the one hand, developers already designing for children appear to be more open to and likely to support designing for children's rights. Market incentives to develop products that might be sold in highly regulated markets, especially Europe, could also encourage attention to rights. On the other hand, competing priorities especially in low income countries make it difficult for developers to accommodate the full spectrum of

children's rights. And most practically, costs constrain developers' capacity to cater to children's rights.

Social and societal conditions also matter. Not only do social and cultural attitudes towards children and childhood constrain developers' efforts to respect children's rights, but specifically, the enthusiasm for children's rights in digital design varies depending on a country's regulatory context. Notably, data protection regulation and, to a lesser degree, online safety regulation, are spreading internationally, thereby drawing attention to children's rights to privacy and safety. This, in some circumstances, can – and could further - pave the way to a wider attention to children's rights in relation to the digital environment. Secondly, policy efforts to mainstream children's rights can also facilitate a child rights perspective in relation to digital design.

However, it is a real challenge for developers to gain and integrate child rights expertise and digital design expertise. Many developers, after all, may work on a children's product at one time but not all the time, so their capacity to invest in a thorough understanding of children's needs is generally limited.

Although the scale of the challenge is huge, the report identifies promising ground for capacity building, training and the provision of rights-informed guidance for designers and developers. It concludes with four recommendations for states, international organisations, investors and digital developers to promote the holistic realisation of children's rights in relation to the digital environment:

- Children's rights should be an overarching objective

- A rights-respecting regulatory environment is needed

- A business case for children's rights is also needed

- It is vital to build capacity for Child Rights by Design.

# Introduction

Digital transformation reflects but also shapes societies' hopes that technological innovations will bring widespread benefits,[1] including in healthcare,[2] manufacturing,[3] education,[4] government services[5] and development.[6] These hopes are articulated and imagined in many ways, but the drivers of change remain overwhelmingly economic, measured in terms of profitability, efficiency and productivity. Too often, the excitement surrounding the opportunities facilitated by new technologies is followed by the 'sobering discovery' of adverse consequences.[7] Children are particularly susceptible to the negative consequences of technology design and use due to their evolving capacities and diverse circumstances.[8]

Given the double-edged impact of digital technologies, this report examines *the factors that shape digital designers and developers' practices and the outcomes for children's rights*. The aim is to identify levers for policy change towards human- and child-centred design to mitigate the challenges that digital technologies pose to children and society. By focusing on the factors that shape developers' practices, this research shows why and how specific policies are needed to overcome barriers to digital innovation that respects children's rights.

Our interviews with digital designers and developers (henceforth, developers) explore how they exercise the generative power of design[9] in negotiation with their business priorities and working contexts to determine the resulting products. By developers, we mean *those directly involved in digital product or service design and development processes*. These include freelancers and individuals working in different sizes and types of organisations, including startups, mid-sized companies, major corporations, public service providers, non-profit organisations and charities, performing various roles.

This research contributed to the United Nations Development Programme's (UNDP) *2025 Human Development Report,* which examined innovative trends in digital

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[1] Kraus et al. (2021), Okolo (2021)
[2] Kong et al. (2023), Väänänen et al. (2021)
[3] Hauge (2023), Yang et al. (2021)
[4] Holmes & Tuomi (2022), Peters & Tukdeo (2024)
[5] Alhosani & Alhashmi (2024)
[6] Brewer et al. (2005), Unwin (2009)
[7] Hilbert (2020, p. 191)
[8] Human Rights Watch (2022), Kleine et al. (2014), Mukherjee (2019), Radesky et al. (2020)
[9] Buchanan (2001)

technologies, with an emphasis on AI, as they affect human development.[10] This, in turn, is grounded in Sen's concept of human development as freedom.[11] According to Sen's capability approach, technology is conceived as 'an input that enables capabilities'.[12] Human rights, including children's rights, are recognised as *valued* components of both the *means* and *end (goal)* of human development.[13] Swist and Collin's 'networked capability approach' offers a useful way to connect children's rights in the digital environment with the capability approach, allowing for the examination of the 'interrelationship' between technology and contextual environment that shapes children's 'freedom' to achieve the quality of life they value and the resulting outcomes for children's rights.[14]

The UN Convention on the Rights of the Child (UNCRC) (1989) is the most ratified international human rights treaty that applies to everyone under 18 (see article 1). Its relevance to the digital environment, including businesses' design and development of digital products and services, and the obligations of states to ensure these businesses respect children's rights, is set out in the UN Committee on the Rights of the Child's General comment No. 25.[15]  Specifically, states have obligations under Article 4 of the UNCRC to introduce laws and regulations to prevent developers from infringing children's rights, monitor their compliance and ensure effective enforcement and remedies for child rights violations. The UN's *Guiding Principles on Business and Human Rights*[16] and the *Children's Rights and Business Principles*[17] provides the framework for digital developers to meet their responsibilities towards children's rights. The *Global Digital Compact*[18] reaffirms states' commitment to respect, protect and fulfil children's rights in response to emerging technologies and the associated opportunities and risks.

Whether developers recognise and are equipped to undertake these responsibilities is currently unknown. This report builds on and incorporates our earlier research with

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[10] UNDP (2025), see also UNDP (2022, 2024b)

[11] Sen (1999). In deriving the outcomes for children's rights from developers' practices, we draw on the capability approach as a way of 'evaluating' external, contextual changes 'in terms of the richness of human life resulting from it' in relation to 'valued activities and capability to achieve these activities' in human development (Sen, 1990, p. 43).

[12] Haenssgen & Ariana (2018, pp. 100–101)

[13] Sen (1999), UNDP (1990, p. 10)

[14] Swist & Collin (2017, p. 678), see also Haenssgen & Ariana (2018)

[15] UN Committee on the Rights of the Child (2021). These documents constitute the international law on how states and other duty-bearers including businesses should protect children from exploitative practices that harm their wellbeing, education and life chances and provide opportunities for children to reach their fullest potential and flourish. These rights also include children's active participation in social, economic and political activities according to their evolving capacities, all of which contribute to human development, as childhood is the critical stepping stone for human development from birth to adulthood.

[16] OHCHR (2011)

[17] UNICEF et al. (2012)

[18] UN Office of the Secretary-General's Envoy on Technology (2024)

developers primarily in the global North[19] by now foregrounding developers' experiences in East Asia and the Pacific, South Asia, Europe, North America, Latin America and Sub-Saharan Africa. We ask - *What factors shape digital developers' practices and consideration of children's rights when designing digital products and services that are used by or impact on children?* From the findings, we derive recommendations for change to motivate and enable developers to embed children's rights in their products and services to mitigate risks and maximise the potential of technologies in advancing human development.

# Methodology

We conducted qualitative research using grounded theory[20] to achieve the research aim and objective. Desk research, a literature review and original interviews provided information relevant to the development of digital products and services across diverse contexts, in ways that are 'understandable' and 'sufficiently general to be applicable' to various daily situations within the area of study.[21] We used NVivo, a qualitative research analytical computer software tool developed by grounded theorists, to code themes identified from the data, from which we derived explanations for developers' practices and their implications for children's rights, thus answering the research question.

## Desk research

The desk research served two purposes. The first was to identify the global digital regulatory trends by searching for high-profile digital regulations, using the International Telecommunication Union's (ITU) Global Digital Regulatory Outlook as a starting point.[22] The second was to identify international efforts and instruments for mainstreaming children's rights as documented in reports, policy documents and guidelines for conducting Child Rights Impact Assessments (CRIA) and embedding children's rights in the digital environment. Together, they provide contextual information about the social conditions that shape developers' practices. We then interviewed developers to identify how they perceive and engage with these conditions.

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[19] Livingstone & Pothong (2023a)
[20] Glaser & Strauss (1999)
[21] Glaser & Strauss (1999, p. 237)
[22] ITU (2023)

# Literature review

We searched the Association for Computing Machinery (ACM) Digital Library for literature published in high-impact international design conference proceedings – *Conference on Human Factors in Computing Systems* (CHI) and *Interaction Design and Children* (IDC) – for research papers and pictorials[23] on designing for children, including children's rights, in 2022–2024. While other sources and databases may be relevant, these two conferences were selected as representative sources of the field as they have dedicated sections on designing for children, making them most efficient for identifying relevant literature.

To grasp the extent to which the current practices in designing for children support children's rights, we searched publications for the past three years (see Appendix 1). These search terms were chosen: 'designing for children', 'children's rights', 'child-centred design' and 'child development'.[24] Given these inclusion and exclusion criteria, we identified 44 out of 2,692 papers published in the CHI and IDC proceedings in 2022–24 that discussed designing for children and their rights for analysis.

# Interviews

We conducted interviews with developers, academics and child rights experts operating in diverse geographical locations, social and economic contexts to obtain insights into developers' practices and compare the dynamics of their interaction within their socioeconomic contexts (see Appendix 2 and 3). As the research scope is global, we sought as diverse a mix of views, roles and operational contexts as possible within a limited time frame. We recruited interview participants through our professional networks and social media (LinkedIn).

Our interviews were conducted in two phases, one under the 5Rights Foundation-funded Digital Futures for Children's (DFC) digital innovation research strand and the other as part of the UNDP's commissioned background research paper. In the first phase, we interviewed 19 participants in Europe and North America to understand developers' practices and develop guidance for developers to design for children's

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[23] In the CHI and IDC, pictorials are papers whose research contributions are conveyed mainly through diagrams and illustrations.

[24] The inclusion criteria were research papers and pictorials that report design approaches to designing for children, design challenges and competing priorities associated with designing for children and their rights. We excluded papers, pictorials, and workshops focusing mainly on design methods or issues such as privacy and safety without discussing design practices.

rights.[25] In the second phase, we expanded the research scope through 24 interviews with developers operating outside the initial two regions to achieve a global representation of developers' practices.

Collectively, the sample size reached 43 interview participants, of which 36 were developers and seven were academics or child rights experts, from Denmark, France, Germany, the Netherlands, the UK, Israel, India, Sri Lanka, Indonesia, Lao PDR, Thailand, Brazil, the USA, Kenya and Nigeria. These countries represent diverse human development contexts from very high to low values on the Human Development Index (HDI) across North America, Europe, East Asia and the Pacific, South Asia, Latin America and sub-Saharan Africa.[26]

To ensure consistency and comparability across the two phases of interviews, we used the same topic guide, covering three key themes: (1) digital products and services the interviewees were working on; (2) design considerations; and (3) factors shaping developers' practices.

This research was approved by the Research Ethics Committee of the London School of Economics and Political Science (LSE) (ref 14949). Interviewees' details and product names are anonymised unless they explicitly requested that their product be named.

# Analysis

We applied thematic analysis to the academic design literature and the interview transcripts, as research shows that this approach effectively responds to questions about practices and their contributing factors.[27] We identified key themes and related them to the research questions and a child rights framework, operationalised through the Child Rights by Design (CRbD) principles, developed from the synthesis of the UNCRC and General comment No. 25 (see Figure 1).[28]

We classified both literature and interview data by country and HDI ranking to observe any similarities and differences in the dynamics between developers' practices and their contextual factors (see Appendices 1 and 4). We provide further methodological explanation in Appendices 3 and 4.

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[25] Livingstone & Pothong (2023a)
[26] UNDP (2024a). The 'human development index' (HDI) is based on 'a very minimal listing of capabilities' to achieve 'a minimally basic quality of life'. UNDP ranks countries' development status according to their HDI values from 'very high' (0.8 or above) to 'low' (0.517 or below), based on available statistics beyond gross national product (GNP).
[27] Clarke et al. (2015), Sldaña (2021)
[28] Livingstone & Pothong (2023a)

# Figure 1: The 11 principles of Child Rights by Design

**1. Equity & Diversity**
Be inclusive, treat people fairly and provide for diverse needs and circumstances

**2. Best Interests**
Embed children's best interests in developing policies and products

**3. Consultation**
Engage and listen to the views of children in developing policies and products

**4. Age Appropriate**
Develop policies and products appropriate for child users or adaptable for different ages

**5. Responsible**
Comply with laws and policies relating to child rights and provide remedies as needed

**6. Participation**
Enable children's expression and access to information and digital publics

**7. Privacy**
Embed privacy-by-design and data protection in policy and product design and use

**8. Safety**
Embed safety-by-design and data protection in policy and product design and use

**9. Wellbeing**
Enhance not harm children's physical and mental health

**10. Development**
Enable children's learning, imagination, play, belonging and fullest development

**11. Agency**
Support children's decision-making and reduce exploitative product features & business models

In the following sections, the findings are organised according to the factors shaping developers' practices, with an explanation of their implications for children's rights. Quotes from interviewees (numbered as P1-P43; see Appendix 2) are used to foreground developers' voices, especially those outside Europe and North America, which are rarely heard in design and child rights research.

# Market conditions matter

The research shows that a small number of developers worldwide are open to designing for children's rights but they face competing priorities and cost constraints. Despite research evidencing that mainstream digital developers' business models and the resulting design practices impede or infringe on children's rights more than support them,[29] the research reveals that a small community of developers worldwide strives to support child development and wellbeing. Although these developers' practices can support a broad range of children's rights, analysis of the design literature and interviews raises two key constraints on developers' ability to design for children and their rights.

## Intentions to design for children aid their rights

The design literature in the field of child–computer interaction (CCI)[30] suggests that developers who design for children are informed by child development theories.[31] Analysis of the literature in this field (see Appendix 4) shows that developers who follow this design tradition, operating in and outside Europe, carefully consider children's diverse requirements and evolving capacities, which allows them to accommodate a broad spectrum of children's rights including and beyond legal requirements for safety and privacy.

In line with the literature, the interview analysis shows that those designing for children operating in diverse regions are more akin to accommodating children's diverse requirements than those developing digital products and services for adults or mainstream users. For example, P7, P8 and P33 focused almost exclusively on the safety and privacy of users in their product development, while those who designed for children, for example, P1, P2, P10, P12, P13, P20, P31, P32 and P43, considered ethics,

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[29] Lupton & Williamson (2017), van der Hof et al. (2020, 2022)
[30] Hourcade (2015)
[31] Baykal et al. (2018), Bekker (2022), Hourcade et al. (2018)

evolving capacity, inclusivity, participation, development and wellbeing of children. Interviewees' accounts suggest that their choice to design for children is motivated by various factors. For example, P13's motivation comes from brand identity:

> *Designing for children is a little bit different because you also need the ethics part of it... [Our company] is an old brand and has always been seen as 'the good toy'. We need to be on that side ... even though we're moving into the digital world now. (P13, senior design strategist, children's physical and digital products, Denmark)*

P31 and P32's motivation to design for children (both educational game developers based in Brazil) resides in their intended users and design challenges that their products are intended to solve. They considered various factors, including the age and developmental capacity of children (their intended users) and the condition of their research funding from the government, that the outputs must constitute a public good and be made freely available to publicly funded schools. Given the purpose of their games, both put effort into ensuring their games yield educational benefits by consulting children to understand their needs and get their feedback on prototypes to ensure usability.

P31 engaged a neuropsychologist to evaluate the game's effectiveness on children's cognitive functions with 300 children. Focused on a game that teaches children about history, P32 noted that close attention was paid to representing ethnic diversity within the community through character design to ensure diversity and overcome religious biases among certain groups. P32 also considered accessibility for children with disabilities, privacy and data protection when collecting data to evaluate the game's effectiveness.

Developers' decisions to design for children also comes from the organisations' missions, as demonstrated in use cases 1 and 2, according to P20, co-founder of a (free-to-play) cybersecurity game in the Netherlands, and P43, a Sri Lankan charity developing a youth mental health mobile application. The use cases are developed from developers' accounts of their practices.

**USE CASE 1**

**HackShield Future Cyber Heroes is an educational game designed to drive a social movement to train children aged 8 to 12 to become cyber agents. As a social movement, the developers used gamification and storytelling to support children in developing their knowledge and skills to manage cybersecurity and online risks, and connect players with their local municipalities and local police force to give players a reason to apply the knowledge and skills they developed in real-life situations, and be rewarded or acknowledged for their efforts.**

**Stepping into the HackShield world, children can create their avatars. They become immersed in scenarios that are metaphors of the internet, interacting with diverse characters embodying different themes, such as data thievery or a dark hacker. The game offers a safe space for players to make mistakes, learn from them without real-life consequences, and develop strategic and adversarial thinking as they anticipate what someone might do to exploit them.**

**Alignment with CRbD principles: Equity and diversity, age appropriate, responsible, participation, privacy, safety, wellbeing, development and agency.**

**Business model: This game is available and accessible online, free of charge. The developer, a game company based in the Netherlands, assigned a budget from their existing revenue to develop it. The company adopts the national understanding of 'social enterprise' as its business model. The company is therefore 'impact-driven' through 'reinvestment of potential profit' (P20). It relies on public and private partnerships by licensing the game content and training materials with uptake in Brazil, Curaçao, Germany, Sweden and the Netherlands.**

Although other developers' accounts also lend themselves to use cases, the two cases presented here best demonstrate the influence of an organisation's mission on designers' practices and the resulting child rights outcomes.

Driven by a mission to prevent and protect women and children from sexual violence online and make mental health services accessible and affordable, P43 led the development of a mobile mental health application with funding from an international organisation and a Sri Lankan-owned business in kind (Use Case 2).

Given the range of digital products and services for children discussed in the interviews, collective efforts to design for children align with various CRbD principles, including equity and diversity, consultation, age appropriate, responsibility, participation, privacy, safety, wellbeing, development and agency. However, individually, depending on the

products and contexts of use, digital developers may consider a narrower range of rights, as summarised by the CRbD principles.

**USE CASE 2**

**The mobile mental health application integrates mental health services and learning modules on the prevention of violence against children and women for service users aged 12 to 19. The 60 participants in the pilot project are assigned a pre-programmed mobile handset for safety, privacy and security. This allows users to access full mental health and training modules offered by the charity (based in Sri Lanka), although restricting users to selected external communication services, such as Zoom and WhatsApp.**

**The application has four core features: (1) counselling, which allows participants a brief chat with their counsellor and appointment booking; (2) two learning modules on relationship building and gender stereotypes; (3) self-help audio recordings for guided meditation and body scanning; and (4) journal entries, which participants can choose whether to share with their counsellor. It also includes a baseline survey to collect demographic data, a childhood trauma scale, a strength and difficulty questionnaire, a positive youth development scale and a gender equality scale, which have been tested with CARE International in Sri Lanka to identify underlying contributing factors to mental health issues and monitor progress.**

**Alignment with CRbD principles: Age appropriate, participation, privacy, safety, wellbeing and agency.**

**Business model: The application is currently only available free of charge to the pilot project participants. With further funding to scale the technical and counselling capacities, the pre-programmed mobile handsets with this mental health application will be made available free of charge to more Sri Lankan users.**

# Competing priorities constrain children's rights

Even those designing for children whose practices are already closely aligned with children's rights struggle to accommodate the full spectrum of children's rights due in part to diverse and multifaceted competing priorities. The design literature offers rich evidence for product-oriented competing priorities, stemming from tensions across different product features, such as balancing safety with participation in children's social

media.[32] Analysis of the design literature suggests that developers found these competing priorities challenging but could, with a careful balancing act, accommodate them. However, the scope of their design consideration tends not to cover the full spectrum of children's rights because their design approaches are predominantly based on child development theories rather than the holistic (child) rights-based approach.

Interviews with developers revealed added complications from commercial pressure, resulting in competing priorities between developers and investors or clients:

> *[White labelling] is a company saying, we want this in the game that you're creating. We'll pay you X amount... I know we were offered some quite exciting partnerships to that effect. Realising we'd have to just not be in control of the creative work, we weren't interested in that at all, even though it would mean that financially, we'd be under less pressure... We're aiming towards not a [venture capital] ... because education companies take a long while to grow. (P6, CEO and product manager of an educational game startup, UK)*

Clients' priorities, often profit-driven, dictated developers' design decisions, resulting in a limited range of children's rights being considered, if at all, or outright violating children's rights, as P19 (a design academic, UK) observed. Others (P1 and P24) expressed similar views:

> *Repetitive. Just bums-on-seats content. We get it all the time. We're a commercial business. We need to pay rent and pay staff... We're not going to turn work down, but at the same time, you do bite your fingers ... and go, God, if they'd put a bit more money into this, we could have created something that was ... thoughtful that would not only support ... the brand ... but also give back something ... more meaningful and playful to the audience. (P1, founder, digital design agency, UK)*

> *I think the challenge is finding the time for development on the features not prioritised by [client's] leadership. There are so many features that we want to develop, but ... we have limited resources. (P24, product design manager, EdTech, Indonesia)*

These quotes represent the market dynamics experienced by developers operating in and outside Europe. The financial influence investors (P6) or market demands exert over developers' design intentions (P1 and P24) dictates digital developers' capabilities

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[32] Livingstone et al. (2023)

and agency to fulfil children's protection, provision and participation rights. Currently, commercial pressure is limiting the range of children's rights that developers can incorporate into the digital products and services they develop.

# Costs constrain designing for children's rights

Regardless of where they operate and their country's HDI score, most digital developers observed that designing for children's rights is resource-intensive and adds upfront investment costs. P37's comment vividly summarises the sentiment of other developers sharing similar experiences about the costs of designing for children:

> *Implementing child rights in some cases is expensive... It's expensive because you have to take all these ethical considerations, putting all these measures [in place] ... And the cost is not only in monetary terms; it's in terms of time. (P37, information platform developer and child rights advocate, Kenya)*

In some cases, especially among developers providing for mainstream or adult users, designing for children's rights is perceived as not 'viable' regarding financial costs and the design flow. For example, in considering safety and age verification or age assurance measures for the product, P8 (CEO and product manager of a social media startup, Germany) told us that these safety measures, such as content moderation and age verification, would be implemented 'manually' in the stage of development where user numbers were below '500,000 users.' In this case, P8 identified financial costs as the determining factor: 'It all depends on the capital I have... The reason we're doing a lot of things manually is having APIs (application programming interfaces) is a cost, and we just don't have the budget for that right now.'

As most developers operating in and outside Europe who identified costs as constraints are small and medium-sized enterprises (SMEs) or startups, this factor likely affects developers who are SMEs, startups and charities more than they do larger corporations. It can be inferred from P43's experience that SMEs, startups and small charities in countries with lower HDI values are likely more constrained than their counterparts in countries with higher HDI values due to limited funding and ethical investment:

> *We are grantees of sexual violence research Initiative. We got the grant back in 2022 to pilot this project... The app cost is more than what we got. So, the [Sri Lankan] tech company ... did certain work, pro bono, for us as part of [their] CSR [corporate social responsibility] ... [and] we have been like looking for new grants. (P43, youth mental health mobile application developer, Sri Lanka)*

Often, this means organisations might not be able to start developing digital products and services for children in the first place, or if they have the seed funding to start, they might not have enough money to sustain their provision.

# Social conditions matter

Desk research and interview analysis reveal the potential of global ICT and digital regulatory trends, child rights mainstreaming efforts, local values and cultures to drive digital developers' considerations and support for children's rights. However, the momentum for children's rights in digital design varies depending on the regulatory development paths countries are on, the level of child rights awareness and expertise developed through child rights mainstreaming and cultural attitudes towards children and their rights.

## The importance of laws and regulations

Laws and regulations can set minimum requirements for developers to fulfil children's rights, but they lag behind technological advances.

> *States Parties shall undertake all appropriate legislative, administrative, and other measures for the implementation of the rights recognised in the present Convention. With regard to economic, social and cultural rights, States Parties shall undertake such measures to the maximum extent of their available resources and, where needed, within the framework of international co-operation. (Article 4, UNCRC, 1989)*
>
> *Opportunities for the realisation of children's rights and their protection in the digital environment require a broad range of legislative, administrative and other measures, including precautionary ones. (General comment No. 25, para. 22)*

In line with this obligation, the OECD[33] identifies various digital policy and regulatory initiatives to protect and promote human rights, including children's rights worldwide, by promoting digital access and protecting people from safety, security and privacy

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[33] OECD (2024b)

risks. However, there was a high concentration of initiatives in Europe and countries with 'very high' HDI values.

Digital access is often enabled through communications regulation, and one of the core objectives that enables the fulfilment of children's rights is universal access,[34] including broadband internet. This regulatory objective supports children's rights to non-discrimination (Article 2, UNCRC) and, as the internet is an infrastructure for information as well as expression, non-discriminatory access to the internet also supports children's civil rights and freedoms (Articles 7, 8, 13–15, 17, UNCRC).[35]

Many domain- and issue-specific domestic laws and regulations worldwide that initially apply in the non-digital environment protect and promote certain rights, such as criminal laws to protect against risks and harms to life,[36] consumer protection laws[37] and legal mandates for equality.[38] These are common worldwide and can be adapted and applied to the digital environment. However, given the scope of this report, we focus on digital regulations, specifically addressing risks emerging from the growing deployment and use of digital technologies. These tend to be driven by initiatives from Europe and North America and focus more on safety, privacy and data protection, mainly addressing children's protection rights.[39] Some of these national and regional laws and regulations are spreading, not least in principle, across the globe.[40] Research shows that these regulations are beginning to shift developers' practices at the design and policy levels, as observed in companies' (e.g., Meta, Google, TikTok and Snap) announcements of product and service changes relating to children in the UK.[41]

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[34] Aufderheide (1999), Michalis (2007, 2014)

[35] An example of such regulation is the European Union (EU) Audiovisual Media Services Directive (AVMSD) (EU 2018/1808). Other examples are the net neutrality rules, prohibiting unfair discriminatory treatments or prioritisation of internet traffic, which have been made regional regulation in Europe (Regulation (EU) 2015/2120), and national laws in the USA (FCC, 2024) and the UK (The Open Internet Access (EU Regulation) Regulations, 2016). Similar net neutrality rules have also been adopted in Brazil, India and Chile (Nguyen et al., 2020)

[36] Boister (2003)

[37] Benöhr (2020)

[38] Andrews (1993), Fox (2000)

[39] Examples include the UK and Australian Online Safety Acts, the UK Age Appropriate Design Code (AADC), the EU Digital Services Act, the EU AI Act and the General Data Protection Regulation (GDPR), which applies to EU member states and the UK.

[40] For example, the UK AADC has been adopted in the USA (California and Maryland), Ireland and the Netherlands (5Rights Foundation, 2023, 2024). Indonesia is following suit, having adopted the UK AADC principles in its draft child protection code within electronic systems regulation (Damazo-Santos, 2024). Other countries outside Europe, such as Kenya (Data Protection Act, 2019), Indonesia (Salim, 2024) and Thailand (Personal Data Protection Act, 2019) have also adopted and adapted their data protection regulations, often modelling them on the EU GDPR.

[41] Wood (2024). These changes mainly addressed content and cross-cutting risks, such as privacy risks and risks from advanced technologies, including AI, the Internet of Things (IoT) and predictive analytics. As revealed by another study, in 2021, Google agreed to make organisational, contractual and technical changes to address substantive privacy risks identified by Privacy Company's Data Protection Impact Assessment (DPIA) commissioned by the Dutch government, following intense negotiations with the government (Nas & Terra, 2021a&b)

In line with findings from the desk research, developers and child rights experts operating in and outside Europe and North America recognise that regulations play a part in setting a minimum standard for what digital developers must do to fulfil their responsibilities towards children's rights:

> *From my experience working with companies, it's almost the carrot and stick thing... Those who think about child rights in terms of, let's go read the design guidelines, they're intrinsically motivated designers who want to make a difference... But they are the minority... The majority just do what they need to do, and those leading companies usually have other interests in mind, and they will go by regulations. (P5, co-founder, UX company, Israel/USA)*

> *In Brazil, we have our data protection law ... we have very strong child's rights ... Our law that protects specifically children [states] each right goes from 1990... So, this was ... the cornerstone to [developing] ... a legal culture and a societal culture to protect children in different aspects, including business, and now in the digital environment... When we talk about the best interest of the child, which is a common law ... [in] Brazil, it's a different way to apply that because we have a statutory perspective on children's rights. (P30, child rights advocate, Brazil)*

On a rare occasion, developers may identify an opportunity to create new services in response to regulatory requirements. For example, a co-founder of an AI-driven SafetyTech startup in India (P25) seized the opportunities opened by national and international online safety regulations to develop AI-powered products to address AI-generated deepfakes, mis- and disinformation.

# Rapid innovation outpaces laws and regulations

Despite the positive influence that laws and regulations can have on developers' practices, they tend to lag behind technology advances and the associated risks and harms that are also emerging, making it difficult to ensure fit-for-purpose laws and regulations.[42] According to the ITU, Europe has the most advanced regulatory instruments for telecom and digital markets compared to North and Latin America, Africa, Asia and the Pacific.[43]

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[42] ITU (2023, pp. 64–69)
[43] ITU (2023)

This finding resonates with the perceptions of various developers operating outside Europe and North America about their countries' digital regulations. For example, P22 (design researcher, EdTech, Indonesia) observed that digital regulation in Indonesia is reactionary rather than preventative. P40 (application developer, healthcare insurance, Nigeria) perceived that safety and children's rights were not Nigeria's focus of digital regulation. Likewise, P34 (EdTech software/system developer, Kenya) remarked that Kenya's internet regulation lagged behind Western nations', exposing children to data protection and privacy risks.

The problems of insufficient legal protections are exacerbated by rapid advances in artificial intelligence (AI) and its growing presence in daily life. The scope and scale of AI risks and harms to people, children and their rights across domains[44] make the global AI regulatory gaps particularly concerning, despite AI's potential benefits.[45]

Europe has paved the way to AI regulation (Regulation (EU) 2024/1689) with the world's first AI Act,[46] followed by the EU General-Purpose AI Code of Practice.[47] The private sector, civil society, governments, academics, industry, professional and international associations have published 83 (and counting) ethical and responsible AI guidelines.[48] The AI Standards Hub's database shows that AI standards addressing various scopes and topics of AI applications are emerging, although most of these guidelines and standards are voluntary, and no international consensus exists on AI regulation.[49]

Specific to children, AI applications in the education domain and automated moderation and recommendation systems that social media companies use could undermine children's rights to life, non-discrimination, education, privacy and other civil rights, for example, to expression and information without adequate legal protection.[50] Children's exposure to AI risks and possible child rights infringement is likely greater in countries with lower HDI values on different regulatory development paths than in Europe and North America.

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[44] Browning & Arrigo (2021), McStay & Rosner (2021), Osoba & Welser IV (2017), Salloum (2024)
[45] Alhosani & Alhashmi (2024), Chen et al. (2022), Hoppe et al. (2023)
[46] European Parliament (2023)
[47] European Commission (2024a)
[48] AlgorithmWatch (2019)
[49] In the case of the UK, its new Data (Use and Access) Bill (2024) permits automated decision-making (ADM) in most cases, provided that adequate safeguards are in place to allow individuals to obtain meaningful human interventions and challenge decisions (Pinsent Masons, 2024). This provision removes restrictions on ADM further than the old Data Protection and Digital Information (DPDI) (No. 2) Bill amending the UK GDPR provisions. Hooper has raised concerns about the risks ADM provisions in the old DPDI Bill could expose people and children to without adequate accountability and redress measures (Hooper, 2024, p. 82)
[50] Hooper (2024)

# Enforcement effectiveness varies widely

While having up-to-date laws and regulations is a good start, ineffective enforcement is a missed opportunity for laws and regulations to shape positive outcomes for children's rights. Still, digital regulatory enforcement qualities vary across application domains and jurisdictions. Research shows that data protection regulatory enforcement is less effective, for example, in education than in health,[51] in the UK than in Europe.[52] Data from TheGlobalEconomy.com shows that governments in Europe and North America are more effective at implementing policies and regulations that improve developers' practices than elsewhere.[53]

This finding resonates with the perceptions of developers operating in countries outside Europe and North America about the effectiveness of regulatory enforcement in their jurisdictions. Such ineffective enforcement manifests in different forms. P28, a freelance designer and artist in Laos PDR (Lao People's Democratic Republic), observed that the same regulatory restriction, for example on content encouraging alcoholic consumption, did not apply as effectively to new media (e.g., social media and video streaming platforms) as to traditional media outlets (e.g., print and broadcast). In Kenya, ineffective enforcement manifests through developers' patchy regulatory compliance (P35, cybersecurity solution developer, Kenya), resulting in digital products and services not in children's best interests (P34, EdTech software/system developer, Kenya) and inadequate child online protection (P35).

# Developers struggle to navigate regulations

In keeping up with rapid technology advances, the ICT and digital regulatory landscape has become increasingly complex. Developers, particularly SMEs and startups, even those in countries with high HDI values, struggle to navigate this fragmented regulatory landscape. This is reflected in regulatory compliance gaps, as evidenced in research on digital products and services available to children in the UK.[54]

Our interview analysis shows that various digital developers across various jurisdictions found regulations in their countries taxing, constraining creativity and deterring them from engaging with children's rights. For example, when asked whether and how

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[51] Day et al. (2024)
[52] Livingstone et al. (2024)
[53] TheGlobalEconomy.com (2022)
[54] Livingstone & Pothong (2023b)

developers experienced the tensions between regulatory compliance and innovation, P12, executive innovation product manager at a UK public service broadcaster, replied:

> *Yes, I think so. A lot of big products like iPlayer will be the same as well. To try and keep on top of the business-as-usual tasks, it's a full-time job. There is no extra space to be doing the innovation ... [or] creative ideas that everybody ... joined the company to do.*

P29, a (commercial) product owner and educational game developer in Brazil, echoed a similar sentiment:

> *[If] you cannot market, you cannot make much profit. There are no investments for it. So that's when we see that kids are playing and watching things that are not for them because the things that should be made for them are not being made because they are so heavily regulated that they became non-sustainable.*

The common sentiment shared by P12 and P29 about regulation suggests that regulatory burdens are felt across nations, national policy paths and organisation sizes.

Collectively, the desk research and interview analysis show that digital regulation has the potential to oblige digital developers to provide for CRbD principles of safety, privacy, wellbeing and agency principles and, in some cases, equity and diversity, best interests and age appropriate, depending on where they operate. However, interviews with developers outside Europe suggest that countries with lower HDI values outside Europe tend to adopt digital regulatory instruments from countries with higher HDI values in Europe and North America and adapt instruments to their local contexts but are often less effective in applying them. This situation likely results in regulatory inconsistency across the globe.

# Mainstreaming child rights

Child rights mainstreaming helps policies and design accommodate children's rights, but more expertise is needed. Our desk research and interview analysis identified various international efforts to advance children's rights through awareness raising and providing guidelines for CRIA and CRbD. However, the digital developers and child rights advocates we interviewed still observed inadequate child rights expertise in policy and design and perceived this as a constraint for embedding children's rights.

# Building capacity for children's rights in the digital environment

Efforts to mainstream children's rights are most prominent in Europe at policy and practice levels, as observed in a series of recommendations for policymakers to embed children's rights in the digital environment[55] and the EU Strategy on the Rights of the Child.[56] The African Union has adopted a Child Online Safety and Empowerment Policy, taking a rights-based approach to implementing child online safety, following General comment No. 25.[57] The Australian government paved the way for child online safety through Safety by Design principles, incorporating children's best interests as their foundation,[58] and subsequently, the Online Safety Act 2021.

In addition to nation-states and supranational institutions, UNICEF, the UN agency tasked with implementing the UNCRC, leads international efforts to embed children's rights in the digital environment through safety assessment tools[59] and a range of toolkits for companies to assess and mitigate their impact on children's rights.[60] UNICEF also provides guidance on CRbD for data protection[61] and rights-respecting AI for children.[62] It has also pilot-tested its 'Policy Guidance on AI for Children'[63] and identified the cross-cutting nature of AI and opacity of the way AI operates, challenging developers and policymakers to apply the guidance.[64] These test results offer rich learning for developers and policymakers keen to apply children's rights in their work.

Other international organisations, such as the ITU, the OECD, the World Bank and the UN Educational, Scientific and Cultural Organisation (UNESCO), also contribute to promoting children's rights. These efforts revolve around digital access and responding to emerging risks. Efforts to promote digital access focus on universal access to

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[55] Council of Europe (2018), Livingstone et al. (2020)
[56] European Commission (2021). Three years later, the European Commission reported various achievements through the EU Children's Participation Platform to promote child participation in public decision-making, a programme of activities promoting good health, equal opportunity for education and wellbeing, and new rules to protect children online (European Commission, 2024b)
[57] Ababa (2024)
[58] Australian Office of the eSafety Commissioner (2019)
[59] UNICEF (2016, 2018)
[60] Pietikäinen et al. (2020), UNICEF (2019, 2021, 2024b)
[61] Hartung (2020)
[62] Dignum et al. (2021)
[63] UNICEF (n.d.)
[64] Pauwels (2021)

broadband internet, driven mainly by the ITU and UNESCO through joint initiatives to drive and monitor broadband development among member countries.[65]

In September 2024, the UN brought together world leaders at the Summit of the Future to forge a new international agreement on the global governance of digital technologies and AI – the Global Digital Compact – grounded in human and children's rights.[66] The adopted agreement includes equity and inclusion in digital access, children's participation rights, protection against risks and harms, privacy breaches and commercial exploitation, with effective remedy and rehabilitation.

These efforts are bearing fruit internationally, fostering child rights-respecting design practices. In countries with very high HDI values, digital developers such as the LEGO Group and the Joan Ganz Cooney Center work with UNICEF to research[67] and develop design tools,[68] advocate and train like-minded designers to build rights-respecting digital products and services by design.[69] This collaboration invited participation from children and developers from countries including South Africa, Malaysia and Vietnam.

So far, the desk research shows that efforts to mainstream children's rights and foster child rights-respecting design among digital developers tend to develop in countries with 'very high' HDI values. However, two developers gave concrete examples of how the benefits of these efforts have trickled down to digital developers in countries with lower HDI values:

> *Most of the use is in Kenya, but ... most of our contracts come from organisations in different markets... We worked with a couple of UN organisations... So that means there are clear directions on how to build the products. UNICEF determines that you do not do any harm to kids in terms of if you were sharing their images online ... and ... design in terms of what your colours, even the colours and the theme of your product. (P42, founder and developer, EdTech, Kenya)*

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[65] Broadband Commission (2023). To measure how rights are respected in broadband policies, UNESCO introduced its internet universality indicators, including participation rights (civil rights and freedoms) and privacy (Souter & Van der Spuy, 2019). In partnership with UNICEF and the World Bank Group, UNESCO also drives initiatives to promote digital access to education through EdTech (UNESCO, (n.d.; World Bank (n.d.). In response to emerging digital risks, the ITU, through its Council Working Group on Child Online Protection (COP), provides a platform for awareness-raising and sharing good practices on child online safety issues, assisting member states, especially developing countries, in implementing COP roadmaps (ITU, 2024). These efforts support the fulfilment of children's rights in the digital environment. The OECD also provides guidelines on child online safety (OECD, 2021a), recommendations (OEDC, 2021b) and digital Safety by Design for children (2024c).
[66] UN Office of the Secretary-General's Envoy on Technology (2024)
[67] Kardefelt-Winther (2022, 2024)
[68] UNICEF (2024a)
[69] Joan Ganz Cooney Center (2024a&b)

> *So, when it came to designing our mobile application, we looked at resources from the Australian e-Commission ... because there were quite a lot of ... quality resources... Sri Lanka doesn't have digital security or digital safety. (P43, youth mental health mobile application developer, Sri Lanka)*

It can be inferred from desk research and the interviews that these international efforts to mainstream children's rights helped raise awareness about digital developers' impacts on children's rights and provide guidelines for developers to anticipate and mitigate the negative impact of their products and services on children's rights. They also expand the spectrum of children's rights enshrined in existing laws and regulations, from protection rights to support provision and participation rights.

# Child rights expertise in policy and design is insufficient

Despite international child rights mainstreaming efforts, the digital developers and child rights advocates interviewed almost unanimously observed that expertise in children's rights necessary for policies and digital design remains inadequate where they operate. They described the impact of inadequate child rights expertise in various ways.

In the policy domain, inadequate child rights expertise undermines policymakers' ability to anticipate and account for their decisions on children's rights (P3, independent child policy consultant, UK) and balancing children's best interests with others' (P4, international child rights consultant, UK).

In design, various developers operating in and outside Europe agreed that inadequate child rights expertise combined with the complexity of the digital environment constrain their ability to cater to children's rights. For example, P11 (government and public affairs executive, children's physical and digital products, UK/Denmark) observed:

> *The scale of the operation on physical safety is massive, and it's not just that it's much better resourced... There's a centralised route for [physical] product development whereas digital development is much more fragmented.*

CEO and product manager of a family social media startup in the UK (P7) questioned the practicality and meaning of a control function for a child to grant permission for parents to share their images, reasoning that children under 13 would not know the implications of 'sharenting'. However, they were aware of developers' responsibility to fulfil children's rights.

Limited expertise in children's rights could result in unintended consequences, constraining children's agency over who gets to see whether they are on the school bus, in this case, because children are represented in the system as 'data points' or 'packages', and priorities are given to their safety, necessitating visibility of their anonymised data (P33, founder of (IoT) SafetyTech startup, Thailand). Similarly, constraints on children's agency can also manifest through children's difficulties in disengaging at will because of unplanned, unsupervised use:

> *If the students have the game with them, maybe they will play, play and play because it's a game with nine little games inside. And we ... don't have the end they play up to. (P31, educational game developer, Brazil)*

These accounts of developers and child rights experts suggest that limited child rights expertise is observable worldwide and can result in the piecemeal application of children's rights in policies and design. However, this constraint is more pronounced in countries with lower HDI values outside Europe and North America.

# Children's position in society can constrain their rights

A small community of those designing for children, based mainly in Europe and North America, has long been contributing rich evidence of what good digital design looks like for children.[70] They have also developed various child-centred design approaches,[71] design tools[72] and approaches to child consultation in digital design.[73] Analysis of the design literature shows that those designing for children already have expertise in catering for a broad spectrum of CRbD principles – equity and diversity, consultation, age appropriate, participation, privacy, safety, wellbeing, development and agency (see Appendix 4). Other value-based design practices, particularly the accessibility movement or inclusive design, which align well with the CRbD principle of equity and diversity, have gained momentum among the broader design community, as observed in various tools and toolkits,[74] as well as industry standards.[75]

The worth of children to society can result in public and private financing models for developing and deploying digital products and services that support children's rights.

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[70] Albar et al. (2024), Fiani et al. (2024), Hernandez et al. (2013), Hightower et al. (2019), Wang et al. (2024), Yip et al. (2023)
[71] Baykal et al. (2018), Bekker (2022), Gerling et al. (2016), Grace et al. (2023)
[72] Baykal et al. (2018), Pothong et al. (2024)
[73] Druin (2002), Iivari et al. (2024), Salac et al. (2023), Walsh et al. (2010)
[74] Microsoft (n.d.), University of Cambridge (2024)
[75] W3C® (2024)

For example, in the UK, public service broadcasting (PSB) derives from a paternalistic vision to condition a publicly funded (through a licence fee) enterprise to serve particular national, social, cultural, economic and political objectives[76] in response to the 'needs' of the society[77] rather than an organisation's profits. In this case, children's wellbeing and development are part of the public value, as observed by P10 (principal research engineer, PSB, UK):

> *The Charter ... [sets our] obligations and public purposes, which translate into certain behaviours and approaches. We want to deliver societal change, societal benefit and real public value. You can't do that if you compromise your children's welfare, exclude vast amounts of the population, expose people to harmful content, or tell them news that's not true.*

Similarly, the Thai government's value for safety and security and digital innovation has resulted in government funding, which provided the capital investment for a SafetyTech startup (P33) to develop an IoT-based safety solution for school transport. Without this investment, the company would have had to take out loans, increasing its commercial pressure to generate a higher return on investment, likely resulting in fewer schools being able to afford the product.

However, the interview analysis reveals that such favourable conditions for children and their rights do not apply across all domains and socioeconomic contexts. For example, P4, an international child rights consultant, observed that children's best interests are rarely considered in the UK education policy, but parents' interests are. This attitude undermines children's right to be heard (Article 12, UNCRC), which requires 'consultation' with children (CRbD principle 3). Policy choices that fail to consider children's views often fail to balance children's interests with others in the decision-making process and tend to produce results that are misaligned with children's 'best interests' (Article 3(1), UNCRC, CRbD principle 2).

Developers operating outside Europe, such as Lao PDR, Thailand, India, Sri Lanka and Kenya, observed similar cultural attitudes in policy and design domains. Qualitatively, the accounts of developers operating outside Europe suggest that this problem is more pronounced in countries with lower HDI values outside Europe due mainly to socioeconomic development:

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[76] Humphreys (2008)
[77] Coyle & Woolard (2010, p. 8)

*Digital rights, all of this, is super-luxurious for them. They [95% of the population] are fighting for survival... What do we need tech for? We need tech for business. We need tech for education. For that, we are willing to give up our privacy right now... [In Europe,] they have a very different approach because of their cultural history and what is taught in school. And because they have resources for living. (P25, a co-founder of an AI-driven SafetyTech startup in, India)*

*Given the social conditions and the type of culture in Sri Lanka, it seems like children don't really have rights... What we focus on is getting [children] nutritious meals, getting them to the school, protection from sexual violence ... and that is a nation's responsibility. (P43, youth mental health mobile application developer, Sri Lanka)*

This dismissive cultural attitude towards children and their voice in policy domains often undermines their voices and requirements in design practices, irrespective of socioeconomic contexts:

*The cultural impact is so huge, but it is tricky because when you get to child rights, for example ... why didn't, for example, the US sign on child rights? Because, in some ways, it didn't fit their culture... So, when you work with companies aiming for the American market, they are absolutely selling for parents, not kids. (P5, co-founder, UX company, Israel/USA)*

*Children are always an afterthought because they don't have the buying or political power... So, they do not build the platforms thinking that children are going to use them. (P37, information platform developer and child rights advocate, Kenya)*

Both the design literature and interviews suggest that the community value of children and childhood play an important role in motivating and enabling developers to accommodate a broad spectrum of children's rights. However, at the societal level, cultural differences tend to confine public, private and civil society's provision for children's rights application in policies and digital design to serve the protection agenda mainly.

# Conclusion: levers for change

The research findings suggest a relatively child rights-friendly environment worldwide. However, the dynamics between developers and their contextual environments (social and market conditions) have resulted in piecemeal applications of children's rights in digital design in various countries, predominantly outside Europe. This also contributes to the widening disparity between European and non-European countries regarding outcomes for children and human development. To prevent this adversity, we propose a holistic (child) rights-based strategic change (see Figure 2).

## Figure 2: A (child) rights-based strategy for change
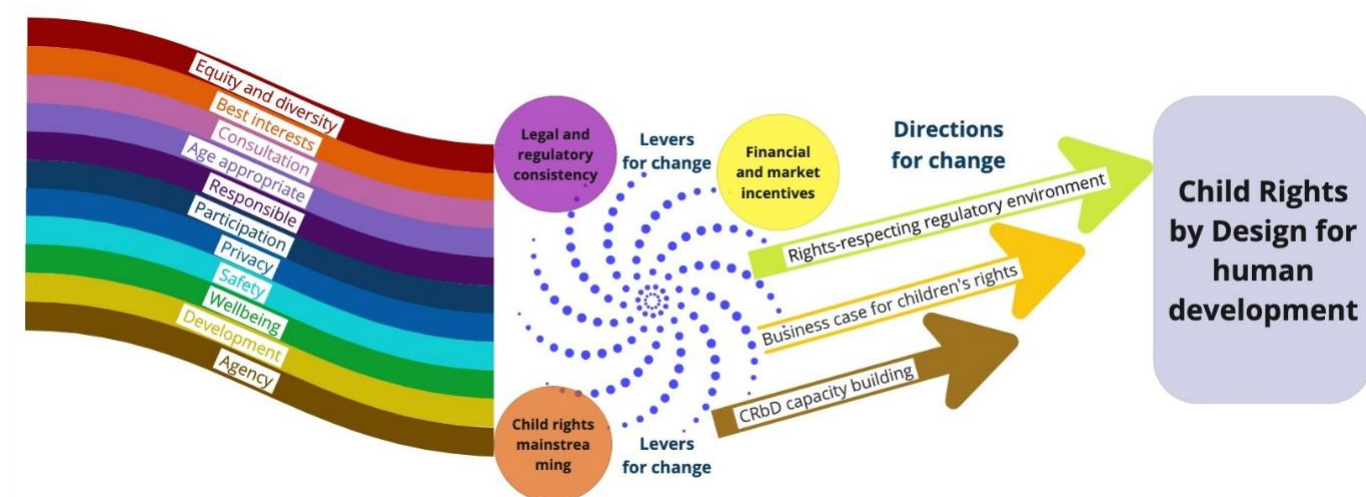


## Children's rights as an overarching objective

As with all human rights, children's rights are interlinked and must not be traded against one another. Shaping and changing digital developers' practices towards child rights-respecting design necessitates a holistic approach. However, the findings show that the existing ICT and digital policies, laws, regulations and international efforts to mainstream children's rights tend to focus on aspects of children's rights, such as safety and privacy, rather than taking a holistic approach, thus resulting in piecemeal application of children's rights. Given the potential of these efforts to affect changes in developers' practices, we recommend prioritising the interrelationship between what they use as a gateway right and other rights, even when they need to be finetuned to hone particular rights for local, organisational or situational relevance.

To this end, we recommend using the 11 CRbD principles[78] as a language to embed and communicate the holistic design, policy and regulatory objectives for change. These convey the 54 Articles of the UNCRC (1989) and General comment No. 25 in practical terms relating to design and policies. Through the holistic CRbD approach, children stand a better chance of appropriating the opportunities, for example, to information, public services and social, economic and political participation, with minimised risks to their development and wellbeing. The opportunities that rights-respecting technologies afford children contribute to human development in the long run.

Recognising market and social constraints in designing for children and their rights identified in the findings, we recommend three directions for change: (1) a rights-respecting regulatory environment; (2) a business case for children's rights; and (3) CRbD capacity building. Each comes with levers for change (see Figure 1).

# A rights-respecting regulatory environment

As one of the significant roots of disparity in technology development outcomes for children resides in the different digital regulatory development paths countries are on, regulatory consistency across borders is needed. The scope of these regulations should also be expanded beyond the current focus on safety and other protection rights (e.g., privacy) to promote children's positive rights beyond digital access.

States have legal responsibilities under Article 4 of the UNCRC to devise appropriate legislative and other measures to protect and fulfil children's rights, including working within international cooperation frameworks. Given the differences in regulatory development paths across European and non-European countries, especially those with lower HDI values, more efforts are needed to coordinate and align global digital regulatory priorities and approaches to promote international regulatory consistency, building on the momentum for human rights due diligence legal mandates.[79]

Initiatives such as the Global Digital Compact[80] and other platforms like the ITU's COP[81] and OECD's Digital Policy Committee[82] are good examples. Importantly, these efforts must encourage active and equal participation from countries with lower HDI values

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[78] Livingstone & Pothong (2023a)
[79] B-Tech (2024)
[80] UN Office of the Secretary-General's Envoy on Technology (2024)
[81] ITU (2024)
[82] OECD (2024b)

outside Europe and North America to make the resulting agreements relatable and applicable in diverse contexts.

We acknowledge that the speed of change towards international regulatory alignment may vary depending on national contexts and interests, which makes the international cooperation frameworks fiercely political. However, these differences reinforce the importance of multistakeholder and multijurisdictional engagement to identify and address any blockers for international regulatory consistency.

# A business case for children's rights

Our findings demonstrate that developers perceived designing for children's rights as resource-intensive and regulatory compliance burdensome. This is especially true for SMEs, startups and charities, which need financial support and incentives to realise children's rights. They also show that SMEs, startups and charities rely on government or international organisation funding, responsible investment and financing models driven by public good rather than commercial profits to cater to children's rights. Therefore, we recommend that states, funding organisations and investors explore diverse financing models, including social enterprise (see use case 1), to support and encourage developers to design for children and their rights.

To this end, states should devise policies and measures to incentivise domestic and foreign investment in products for children and their rights. This can guide the investors who increasingly require digital developers to report on their impact on human and children's rights as part of their environment, social and governance (ESG) reporting,[83] Some specifically require them to design for children's rights (P42, founder and developer, EdTech, Kenya). States, industry associations and design communities should also consider schemes to recognise and promote child rights-respecting innovations to generate market value for child rights-respecting products and services to boost developers' interests in designing for children and their rights.

Given socioeconomic differences across jurisdictions, government funding may not be available. However, responsible private investments are not confined within national borders. States can devise policies and incentives to attract these investments to motivate and help local developers overcome cost barriers in designing for children and their rights.

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[83] B-Tech (2024)

# Building capacity for Child Rights by Design

Despite international efforts to mainstream children's rights and some success in child rights capacity building, developers operating in and outside Europe still reported having inadequate expertise to design for children's rights. In addition, the findings from the value for children section show that the wealth of design knowledge and child rights expertise is concentrated in Europe and North America. At the same time, European cultures are also more supportive of children and their rights, as compared to various other countries, such as Thailand, Lao PDR, Sri Lanka and India, where children are not the country's top priority, and nor are their voices culturally respected.

To overcome these constraints on developers' capability to design for children's rights, we propose six voluntary measures for states and international organisations to consider:

- International partnerships between international organisations (e.g., UNICEF and international NGOs) and local companies, as in the case of the Kenyan EdTech and Sri Lankan mental health mobile application, to develop digital products and services that promote children's rights.

- Increasing emphasis on children's positive rights, such as child consultation, participation in decision-making affecting them and children's voices in child rights mainstreaming efforts, using them as gateways to fulfil other rights, especially in countries outside Europe and those with lower HDI values.

- Using relevant international standards, such as the IEEE Standard for Age Appropriate Digital Services Framework[84] and accessibility standards,[85] to promote regulatory compliance and build developers' capacity to design for children's rights.

- Production and dissemination of guidelines, toolkits and design tools for policymakers and digital developers worldwide to develop child rights expertise.

- Research and industry partnership to build a repository of evidence on child rights-respecting technologies, developers' practices and business models supporting a child rights-based approach to digital design.

- Funded design fellowship programmes aimed at digital developers outside Europe and North America to support their development of expertise in designing for children and their rights, and fostering a child rights-respecting

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[84] Ruth (2021)
[85] W3C® (2024)

culture worldwide.

This direction for change and the recommendation for creating a child rights-respecting environment align with the UNGPs' calls for states to adopt a 'smart mix' of mandatory and voluntary measures to foster digital developers' respect for human rights, including children's rights.[86] However, these measures may not all work equally well in all contexts. So, state and international organisations should adapt these measures to suit their specific operational and organisational contexts, setting measurable and realistic expectations of their decisions, and breaking these measures down into actionable tasks with a clear completion time frame.

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[86] OHCHR (2011)

# Glossary

*Note: These definitions are adapted from the Digital Futures for Children's Glossary of Terms Relating to Children's Digital Lives[87] and the sources cited therein.*

| Artificial intelligence (AI) | A suite of computing techniques that enable machines to perform tasks that traditionally require human intelligence.[88] |
|---|---|
| Child/children | Individuals aged 18 or under. |
| Child Rights by Design (CRbD) | A set of rights-based design principles developed by the Digital Futures Commission (DFC), now the Digital Futures for Children centre, synthesising the provisions of the UNCRC and General comment No. 25 into a language accessible to digital developers (see Appendix 4). |
| Child Rights Impact Assessment (CRIA) | An iterative assessment for anticipating positive and negative impacts on children and their rights under the UNCRC. |
| Child/children's rights | Children's protection, provision and civic, political, economic, social, health and cultural rights, as stipulated in the UNCRC. |
| Design | A generative process of ideating, planning and creating products (artefacts) and services, generally, to enable people to achieve their individual and collective purposes. |
| Digital access | Individuals' ability to use information and communication technologies (ICT), particularly the internet, as well as information, content, products and services made available with these technologies.[89] |
| Digital developers | Individuals directly involved in digital product or service design and development processes. These include freelancers and individuals working in different sizes and types of organisations, including startups, mid-sized companies, major corporations, public service providers, non-profit organisations and charities, performing various |

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[87] Atabey et al. (2023)
[88] ICO (2024), Stryker & Kavlakoglu (2024)
[89] OECD (2024a)

| | roles. |
|---|---|
| **Digital products and services** | Products and services built on and/or delivered through information and communications technologies (ICT). |
| **Education technology (EdTech)** | A suite of technologies used in education to serve various purposes, including teaching, learning, administrative and safeguarding tasks. |
| **(End) users** | Individuals who directly interact with or intend to engage in a product or service. |
| **General comment** | An authoritative statement of the United Nations' treaty bodies, interpreting the provisions of their respective human rights treaty. |
| **Harm** | Immediate or latent manifestation of adverse physical or psychological impact on a person. |
| **Law** | Mandatory conducts or prohibition thereof, resulting from a legislative process. |
| **Regulation** | Measures for implementing principles established by law. |
| **Risk** | Probability or possibilities of adverse outcomes or harms. |
| **SME** | Small and medium-sized enterprise. |
| **Technology** | Technical instruments derived from scientific knowledge and their application. |
| **UN Convention on the Rights of the Child (UNCRC)** | The most ratified international human rights treaty that applies to children, setting out children's protection, provision, as well as civic, political, economic, social, health and cultural rights. |

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# Appendix 1: Literature review methodology

We searched the literature published in two high-impact international design conference proceedings, Conference on Human Factors in Computing Systems (CHI) and Interaction Design and Children (IDC), for research papers on designing for children, including children's rights. The aim was to discover the extent to which designing for children as a practice supports children's rights.

Having applied the search terms and inclusion and exclusion criteria, we identified 44 out of 2,692 papers published in the CHI and IDC proceedings from 2022 to 2024 that discussed designing for children and their rights. This table shows how we coded the themes in the resulting dataset.[90]

| Conference | Author, year | Paper title | Data source by country | HDI value | Design for child rights | CRbD principles discussed |
|---|---|---|---|---|---|---|
| CHI | Fiani et al. (2024) | 'Pikachu would electrocute people who are misbehaving': Expert, guardian and child perspectives on automated embodied moderators for safeguarding children in social virtual reality | UK | Very high | No | Safety, privacy, agency, age appropriate, consultation |
| CHI | Wang et al. (2024) | CHAITok: A proof-of-concept system supporting children's sense of data autonomy on social media | UK | Very high | Yes | Privacy, agency |

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90 Green & Thorogood (2018, p. 258)

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|---|---|---|---|---|---|---|
| CHI | Wang et al. (2023) | 'Treat me as your friend, not number in your database': Co-designing with children to cope with datafication online | UK | Very high | No | Privacy, agency |
| CHI | Garg et al. (2022) | The last decade of HCI research on children and voice-based conversational agents | USA, France, UK, South Korea, Italy | Very high | No | Development, wellbeing, privacy, equity and inclusion |
| CHI | Lee et al. (2022) | The unboxing experience: Exploration and design of initial interactions between children and social robots | USA | Very high | No | Consultation, development |
| IDC | Albar et al. (2024) | A playful path to sustainability: synthesising design strategies for children's environmental sustainability learning through gameful interventions | West and Central Asia, South America | N/A (no country identified) | No | Development, participation |
| IDC | Currin and Hourcade (2024) | Creating personas of parents of young children based on balancing priorities | USA | Very high | No | Privacy, safety, consultation, wellbeing, development |
| IDC | Elsässer et al. (2024) | Iteratively designing a mobile app for measuring in-group out-group bias with preschool children | Germany | Very high | No | Equity and diversity, consultation |
| IDC | Fernandez et al. (2024) | Design failures in data visualisation programming activities | Sao Paulo, Brazil | High | No | Consultation, development |
| IDC | Fitton et al. (2024) | Investigating the impact of monetisation on children's experience with mobile games | UK | Very high | No | Development, wellbeing, agency |

| | | | | | | |
|---|---|---|---|---|---|---|
| IDC | Hourcade et al. (2024) | [Understanding adult stakeholder perspectives on the ethics of extended reality technologies with a focus on young children and children in rural areas](#) | USA | Very high | No | Safety, privacy, development, wellbeing |
| IDC | Iivary et al. (2024) | [Transformative agency – The next step towards children's computational empowerment](#) | Denmark, Finland | Very high | No | Participation, development, agency |
| IDC | Jin et al. (2024) | [Is your family ready for VR? Ethical concerns and considerations in children's VR usage](#) | USA | Very high | No | Safety, privacy, development, wellbeing |
| IDC | Pothong et al. (2024) | [Applying children's rights to digital products: Exploring competing priorities in design](#) | UK, Europe, USA, Malaysia | Very high | Yes | Full spectrum of CRbD principles |
| IDC | Read et al. (2024) | [Inclusive child engagement in HCI: Exploring ocean health with schoolchildren](#) | UK | Very high | No | Consultation, participation, privacy, development |
| IDC | Stefanidi et al. (2024) | [MoodGems: Designing for the well-being of children with ADHD and their families at home](#) | UK, Germany | Very high | No | Equity and diversity, participation, privacy, safety, agency |
| IDC | Werner et al. (2024) | [Technologies supporting social play in neurodiverse groups of children](#) | Austria | Very high | No | Privacy, safety, development, agency |
| IDC | Zaman et al. (2024) | [Bridging the gaps: Participatory science communication and dissemination with and for children](#) | UK, Germany, Belgium, Portugal, Finland, Poland, | Very high | Yes | Consultation, participation, privacy, safety, development |

| | | | Italy, Estonia | | | |
|---|---|---|---|---|---|---|
| IDC | Zhou et al. (2024) | ['Bee and I need diversity!' Break filter bubbles in recommendation systems through embodied AI learning](#) | USA | Very high | No | Privacy, development |
| IDC | Consentino et al. (2023) | [Designing multi-sensory environments for children's learning: An analysis of teachers' and researchers' perspectives](#) | Norway | Very high | No | Development |
| IDC | Consentino et al. (2023) | [Interaction modalities and children's learning in multisensory environments: Challenges and trade-offs](#) | Italy | Very high | No | Development, wellbeing, agency |
| IDC | Grace et al. (2023) | [Child-centred design in the digital world: Investigating the implications of the Age-Appropriate Design Code for interactive digital media](#) | USA, UK | Very high | Yes | Best interests, age appropriate, privacy, responsibility, safety, agency |
| IDC | Kumar et al (2023) | [Understanding research related to designing for children's privacy and security: A document analysis](#) | USA, UK | Very high | No | Consultation, safety, privacy |
| IDC | Lamichhane et al. (2023) | [When children chat with machine translated text: Problems, possibilities, potential](#) | UK, Nepal | Very high | No | Participation, development |
| IDC | Landesman et al. (2023) | [Let kids wonder, question and make mistakes: How the designers of children's technology think about child well-being](#) | USA | Very high | No | Privacy, safety, wellbeing, development |

| | | | | | | |
|---|---|---|---|---|---|---|
| IDC | Meintjes et al. (2023) | Child-to-child public health messaging through a portable craft tech interactive in rural South Africa | South Africa | High | No | Equity and diversity, consultation, privacy, safety, wellbeing |
| IDC | Read et al. (2023) | Small CCI-exploring app evaluation with preschoolers | UK | Very high | No | Privacy, development |
| IDC | Salac et al. (2023) | Scaffolding children's sensemaking around algorithmic fairness | USA | Very high | No | Consultation, privacy, development |
| IDC | Stefanidi et al. (2023) | MagiBricks: Fostering intergenerational connectedness in distributed play with smart toy bricks | Germany | Very high | No | Development |
| IDC | Xu et al. (2023) | 'Rosita reads with my family': Developing a bilingual conversational agent to support parent-child shared reading | USA | Very high | No | Equity and diversity, consultation, development |
| IDC | Yip et al. (2023) | 'Money shouldn't be money!' An examination of financial literacy and technology for children through co-design | USA | Very high | No | Consultation, safety, privacy, development |
| IDC | Bakala et al. (2022) | Design factors affecting the social use of programmable robots to learn computational thinking in kindergarten | Uruguay | Very high | No | Age appropriate development |
| IDC | Besevli et al. (2022) | Designing physical objects for young children's magnitude understanding: A TUI research through design journey | Turkey | Very high | No | Development, agency |
| IDC | Cagiltay et al. (2022) | Understanding factors that shape children's long term engagement | USA | Very high | No | Development, agency |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | with an in-home learning companion robot | | | | |
| IDC | Druga et al. (2022) | How families design and programme games: A qualitative analysis of a 4-week online in-home study | North America | Very high | No | Development, participation, age appropriate (intergenerational) |
| IDC | Mansi et al. (2022) | Ready, set, art: Technology needs and tools for remote K-2 art education | USA | Very high | No | Consultation, development |
| IDC | McDermott et al. (2022) | Mapping the changing landscape of Child–Computer Interaction research through correlated topic modelling | N/A | N/A (no country identified) | No | Safety, privacy, development, wellbeing |
| IDC | Rubegni et al. (2022) | 'Don't let robots walk our dogs, but it's ok for them to do our homework': Children's perceptions, fears, and hopes in social robots | USA, UK, Spain | Very high | No | Safety, development, wellbeing, agency |
| IDC | Stefanidi et al. (2022) | Designing for care ecosystems: A literature review of technologies for children with ADHD | N/A | N/A (no country identified) | No | Equity and diversity, consultation, development, wellbeing |
| IDC | Wagh et al. (2022) | MoDa: Designing a tool to interweave computational modeling with real-world data analysis for science learning in middle school | USA | Very high | No | Development |
| IDC | Warren et al. (2022) | Lessons learned and future considerations for designing remotely facilitated co-design studies with children | Canada | Very high | No | Consultation, wellbeing |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | focused on socio-emotional experiences | | | | |
| IDC | Yu et al. (2022) | My: Talkies: Designing a craft kit to support learning about communication devices through making | USA | Very high | No | Development, agency |
| IDC | Zarei et al. (2022) | Designing interactive contextual cues for children's video-stimulated writing | USA | Very high | No | Development |

# Appendix 2: Interviewees

| Partic-ipant | Role and organisation | Country | HDI 2023/24 |
|---|---|---|---|
| P1 | Founder, digital design agency (SME) | UK | Very high |
| P2 | Development executive for games and children's media (public service broadcaster) | UK | Very high |
| P3 | Independent child policy consultant | UK | Very high |
| P4 | International child rights consultant | UK | Very high |
| P5 | Co-founder, UX company (startup) | Israel/USA | Very high |
| P6 | CEO, product manager, educational game (startup) | UK | Very high |
| P7 | CEO, product manager, family social media (startup) | UK | Very high |
| P8 | CEO, product manager, social media application (startup) | Germany | Very high |
| P9 | Professor of Law and Digital Technologies | Netherlands | Very high |
| P10 | Principal research engineer (public service broadcaster) | UK | Very high |
| P11 | Public affairs executive, children's physical/digital products (large corporation) | UK/Denmark | Very high |
| P12 | Executive innovation product manager (public service broadcaster) | UK | Very high |
| P13 | Senior design strategist, children's physical and digital products (large corporation) | Denmark | Very high |
| P14 | Political communication, product owner, SafetyTech (SME) | France | Very high |
| P15 | Linguist and co-owner, SafetyTech (SME) | Saudi Arabia | Very high |
| P16 | Independent UX designer | France/UK | Very high |
| P17 | Interactive entertainment (industry) association | UK | Very high |
| P18 | Development behavioural paediatrician, academic | USA | Very high |
| P19 | Academic, immersive storytelling (design) | UK | Very high |
| P20 | Co-founder of a (free-to-play) cybersecurity game | Netherlands/ Brazil/Curaçao | Very high |

| P21 | Design researcher, EdTech (state enterprise) | Indonesia | High |
|---|---|---|---|
| P22 | Design researcher, EdTech (state enterprise) | Indonesia | High |
| P23 | UX designer, EdTech (state enterprise) | Indonesia | High |
| P24 | Product design manager, EdTech (state enterprise) | Indonesia | High |
| P25 | Co-founder, AI-driven SafetyTech (startup) | India | Medium |
| P26 | Director/interaction designer, interaction design studio | Thailand | Very high |
| P27 | Project manager, interaction design studio | Thailand | Very high |
| P28 | Designer and artist, freelancer | Lao PDR | Medium |
| P29 | Product owner and educational game developer (startup) | Brazil | High |
| P30 | Child rights advocate, non-profit organisation for child rights | Brazil | High |
| P31 | Educational game developer (and academic) (government funded) | Brazil | High |
| P32 | Educational game developer (and academic) (government funded) | Brazil | High |
| P33 | Founder, (IoT) SafetyTech (startup) | Thailand | Very high |
| P34 | EdTech software/system developer, web solutions for schools (SME) | Kenya | Medium |
| P35 | Cybersecurity solution developer (SME) | Kenya | Medium |
| P36 | Child rights advocate (charity) | Kenya | Medium |
| P37 | Information platform developer and child rights advocate (non-profit organisation) | Kenya | Medium |
| P38 | Information platform developer (non-profit) | Kenya | Medium |
| P39 | Information platform developer (non-profit) | Kenya | Medium |
| P40 | Application developer, healthcare insurance | Nigeria | Low |
| P41 | Product manager | Nigeria | Low |
| P42 | Founder and developer, EdTech (startup) | Kenya | Medium |
| P43 | Youth mental health mobile application developer (charity) | Sri Lanka | High |

# Appendix 3: Interview methodology

Given the research objective of examining the factors that shape digital developers' practices and the subsequent outcomes for children's rights, we used grounded theory (GT) as the methodology. GT is a widely used methodology for qualitative research in social science that enables the identification of patterns within the data that can then be conceptualised.[91] The emphasis of GT is on the 'discovery of theory from data systematically obtained from social research' rather than quantitatively verifying theories.[92]

Our research objective and aim benefit more from GT's emphasis on the 'discovery of theory' than quantitatively verifying the theory, as per other methodologies, such as the fuzzy-set logic approach.[93] The value of GT for this research paper lies in its power to explain digital developers' behaviours (practices) in relation to the dynamics of their agency – their priorities – and the contexts within which developers operate. Grounding the explanation of digital developers and recommendations for change in developer practices, as reported or recorded in design literature and desk research about broader ICT and digital governance contexts, allows us to account for the subjectivities of developers' experiences in different contexts in ways that cannot be verified quantitatively.

According to Glaser and Strauss,[94] credibility in GT resides in 'the detailed elements of the actual strategies used for collecting, coding, analysing, and presenting data when generating theory, and on how people read the theory.' The decision on what data to collect is based on 'a general sociological perspective and on a general subject or problem area'[95] to ensure the validity of the resulting theory. Therefore, we combined three data collection methods: desk research, rapid literature review and interviews, as described in the Methodology section. Recognising that the research scope is global, we strived to collect data from as many jurisdictions and socioeconomic contexts as

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[91] White & Cooper (2022)
[92] Glaser & Strauss (1999, p. 2)
[93] Ragin (2000)
[94] Glaser and Strauss (1999, p. 244)
[95] Glaser & Strauss (1999, p. 45)

possible within the given timeframe. This rationale for data collection is also translated into the interview question structure below.

## Interview questions

1.  We're sitting here in the UK and notice that the digital market in Europe and the UK is heavily regulated. In Europe, we also care a lot about children's rights. What is it like developing your product where you are based?

    What is the market like?

2.  Now, let's talk about your product (if you are a product owner, manager or member of a product team) or the digital product, platform or service you have worked with (if you are a child safety or child rights advocate).

    (For developers) What prompted your company to develop this product? How does it work?

    (For child rights advocates) What digital products and services have you worked with, and what did you hope to achieve by engaging these companies?

3.  (For developers) What did you take into consideration as you developed your product/service?

    Is there a role for research, for example, user research and (product) impact assessment, in your product/service development? How does that work?

    (For child rights advocates) What do you observe to be the priorities of digital developers that you have worked with? What did they consider when developing their products and services?

4.  What rules, laws and regulations apply to the digital products and services you are working on (or with)?

    How do these rules and regulations shape product design?

5.  How do the organisation's values and interests shape the design and attributes of the products or services you're working on (or with)?

6.  What are the government's policies or initiatives or international collaborations (e.g., driven by organisations such as UNICEF and UNESCO) that you observe as having an influence on or the potential to influence digital product design in your country? How? Why?

**7.**   (For developers) How do you anticipate the impact of your product on children and their rights?

(For child rights advocates) How do products/services that you've worked with anticipate and mitigate the impact of their product/ service on children and their rights?

What are your biggest concerns about this?

**8.**   What prevents developers from considering and embedding children's rights in their products or services?

**9.**   What would motivate and support digital developers in your country to think about and embed children's rights into their products or services even though children don't directly interact with these products?

To cover these questions, we allocated one hour for each interview. Most interviews were conducted in English. The exceptions were the interviews with participants from Thailand and Lao PDR, in which case interviews were conducted in Thai, as the interviewees chose. We provided a Portuguese translation of the interview question structure ahead of the interview for interviewees based in Brazil, and an English-Portuguese interpreter during the interview in case the interviewees needed language support. In cases where the interviews were conducted in Thai, the lead author provided the translation from Thai into English. Where interviews were conducted in parts in Portuguese, the interpreter provided the translation during the interview.

The resulting interview data offered rich ground for observation of similarities and differences in the dynamics of developers' interaction with the market and the social conditions in which they operate.

We analysed the design literature and interview transcripts separately. We analysed the design literature to identify which children's rights are supported by the practices of developers designing for children. This involved mapping the practices recorded in the selected design literature onto the Child Rights by Design (CRbD) principles[96] (see Appendix 4).

We analysed the interview data to identify the factors that shape developers' practices and how these resulting practices support children's rights. We conducted two cycles of analysis on the interview data. In the first cycle, we systematically identified themes by

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[96] Livingstone & Pothong (2023a)

categorically summarising data content.[97] This involves assigning descriptive summaries to the interview data about the factors shaping developers' practices, using the interview questions as a guide, and grouping these according to their nature, for example, economic or social. In the second analysis cycle, we compared developers' practices and considerations with the CRbD principles.[98]  We used the CRbD principles to summarise the outcomes for children's rights resulting from developers' practices. Figure 3 illustrates this thematic identification and their relationships with one another. At the same time, the coding frame (Tables 1 and 2) shows what data content is included in each of them, and how they relate to the interview question structure.

## Figure 3: Themes identified in the interviews and their interrelationships



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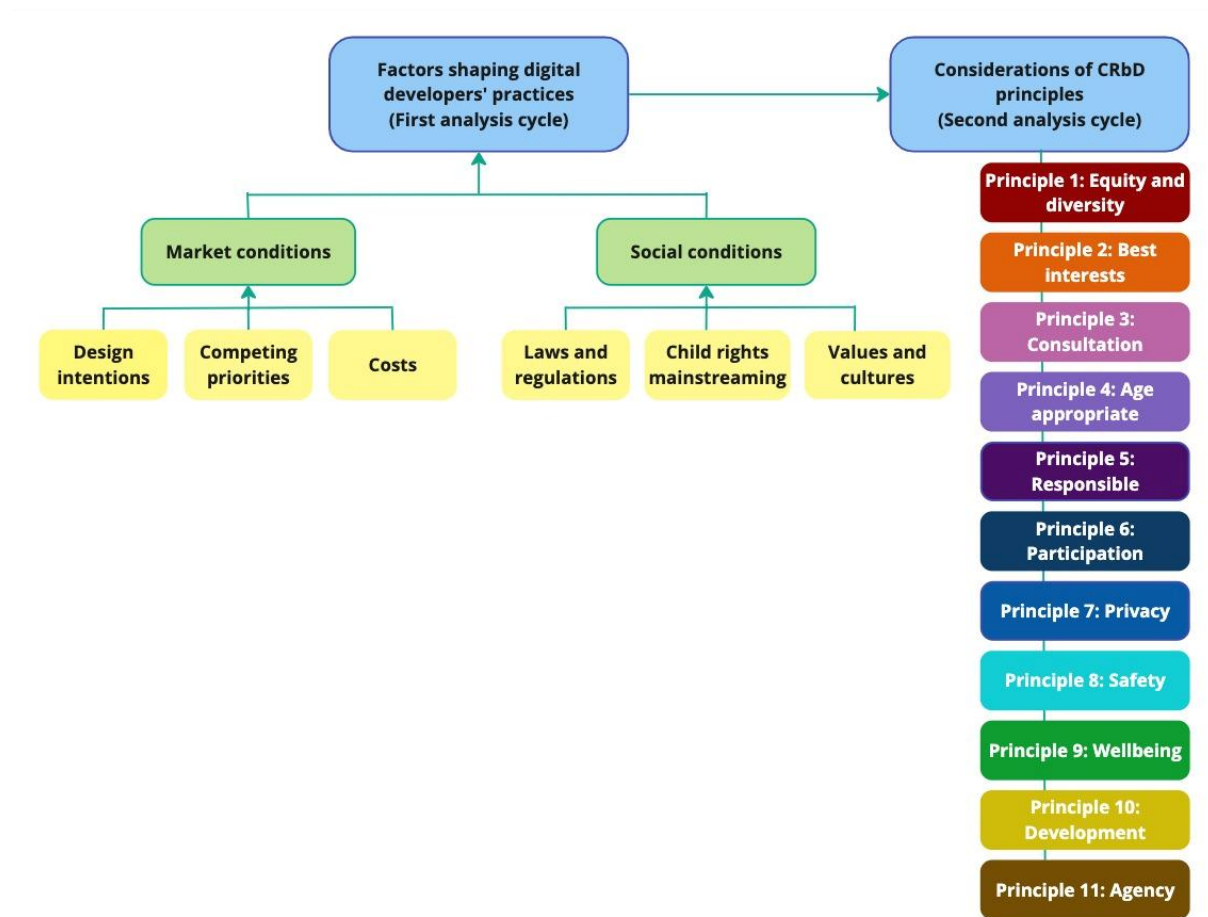
[97] Green & Thorogood (2018, p. 258)
[98] Livingstone & Pothong (2023a)

## Table 1: Coding based on interview questions (first analysis cycle)

| Themes | Coded data content |
|---|---|
| **Design intentions** | Answer from interview questions 2, 6 and 9. Data content coded under this theme describes developers' motivations to develop the product, what the product is and how it operates. |
| **Competing priorities** | Answer from interview questions 1, 3 and 5. Data content under this theme describes tensions in the design and development processes arising from the nature of the products, the organisation's values and interests and market conditions. |
| **Costs** | Answer from interview questions 1 and 8. Data content under this theme describes costs as barriers to designing for children's rights and often unfavourable market conditions, putting pressure on developers to finance their operation costs and generate returns on investments. It also discusses how to overcome the cost barrier. |
| **Values and cultures** | Answer from interview questions 1, 5 and 8. Data content under this theme comes mainly from discussions about the social and market conditions in which developers operate, their own and their organisation's values and interests. This includes discussing values and cultural attitudes as barriers. |
| **Laws and regulations** | Answer from interview question 4. Data content under this theme describes interviewees' understanding of the laws and regulations they think apply to their products and what they do to comply with them. Interviewees described both their positive and negative experiences with the laws and regulations. |
| **Child rights mainstreaming efforts** | Answer from interview question 6. Data content under this theme records interviewees' awareness of international efforts to mainstream children's rights and how these efforts helped them build capacities to design for children's rights |

## Table 2: Coding for child rights outcomes from interviewees' responses (second analysis cycle)

| | |
|---|---|
| **Principle 1: Equity and diversity** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Do you treat all children equally fairly and support vulnerable children? Or a discussion of developers' consideration of this principle.<br><br>(This means being inclusive, treating everyone fairly and providing for diverse needs and circumstances [or not].) |
| **Principle 2: Best interests** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Are children's best interests a primary consideration in policy and product design? Or a discussion of developers' consideration of this principle. |
| **Principle 3: Consultation** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Are children meaningfully consulted in developing your policy or products? Or a discussion of developers' consideration of this principle.<br><br>(This means engaging and listening to [or not] the views of children in product development, design and policy.) |
| **Principle 4: Age appropriate** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Is your policy or product appropriate for child users or adaptable for children of different ages? Or a discussion of developers' consideration of this principle.<br><br>(This means making [or not] your products age appropriate by design and considering using age assurance.) |
| **Principle 5: Responsible** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Do you review and comply with laws and policies relevant to child rights? Or a discussion of developers' consideration of this principle.<br><br>(This means complying [or not] with legal frameworks, providing remedies as needed and conducting a Child Rights Impact Assessment, CRIA) |
| **Principle 6: Participation** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Does your policy or product enable children to participate in digital publics? Or a discussion of developers' consideration of this principle.<br><br>(This means enabling [or not] children's participation, expression and access to information.) |
| **Principle 7: Privacy** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Have you adopted privacy by |

| | |
|---|---|
| | design in policy and product development and use? Or a discussion of developers' consideration of this principle.<br><br>(This means embedding [or not] privacy by design and data protection in policies and product development and use.) |
| **Principle 8: Safety** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Have you adopted safety by design in policy and product development and use? Or a discussion of developers' consideration of this principle.<br><br>(This means embedding [or not] safety by design in policies and product development and use.) |
| **Principle 9: Wellbeing** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Does your policy or product enhance not harm children's mental or physical health and wellbeing? Or a discussion of developers' consideration of this principle.<br><br>(This means enhancing and not harming the health and wellbeing of all children, including through inclusive design [or the complete opposite].) |
| **Principle 10: Development** | Answer from interview questions 2, 3 and 7 that indicate a positive answer to the following question: Does your policy or product enable children's learning, imagination, play and belonging? Or a discussion of developers' consideration of this principle.<br><br>(This means enabling [or not] children's learning, free play, sociability and belonging, and their fullest development.) |
| **Principle 11: Agency** | Answer from interview questions 2, 3 and 7 that indicate positive answers to the following question: Have you taken steps to reduce compulsive and exploitative product features? Or a discussion of developers' consideration of this principle.<br><br>(This means supporting [or not] child users' decision-making and reducing exploitative features and business models that harm their agency.) |

We systematically checked the extent to which the relevant data categories supported the themes identified, according to the analysis objectives. In presenting the explanation of developers' practices, we triangulated findings from desk research, analysis of the design literature and interview data. We focused on explaining the dynamics of digital development that result from the interaction between the developers' agency, developers' design practices, and the market and social conditions within which they operate. The consistency and systematic approach of the analysis is demonstrated through thematic mapping of data sources – the design literature selected for analysis (see Appendix 1) and interviewee attributes (Appendix 2 and 3).

## Table 3: Thematic discussion by participants (first analysis cycle)

| Themes | Developers discussing the themes (N = 36) | Researchers and child rights advocates discussing the themes (N = 7) |
|---|---|---|
| Design intentions | 36 | 4 |
| Competing priorities | 32 | 6 |
| Costs | 32 | 3 |
| Values and cultures | 35 | 7 |
| Laws and regulations | 28 | 5 |
| Child rights mainstreaming | 14 | 6 |

## Table 4: Thematic discussion by participants (second analysis cycle)

| Themes | Developers discussing the themes (N = 36) | Researchers and child rights advocates discussing the themes (N = 7) |
|---|---|---|
| Principle 1: Equity and diversity | 25 | 2 |
| Principle 2: Best interests | 16 | 6 |
| Principle 3: Consultation | 25 | 6 |
| Principle 4: Age appropriate | 26 | 4 |
| Principle 5: Responsible | 30 | 5 |
| Principle 6: Participation | 23 | 3 |
| Principle 7: Privacy | 30 | 5 |
| Principle 8: Safety | 29 | 6 |
| Principle 9: Wellbeing | 19 | 5 |
| Principle 10: Development | 27 | 4 |
| Principle 11: Agency | 24 | 4 |

# Appendix 4: Child rights by design principles

| Child Rights by Design principles | Livingstone & Pothong (2023a) | UNCRC articles | General comment No. 25 paragraphs |
|---|---|---|---|
| Principle 1: Equity and diversity<br><br>Do you treat all children equally fairly and support vulnerable children? | Equity and diversity (non-discrimination, family and alternative care)<br><br>Be inclusive, treat everyone fairly and provide for diverse needs and circumstances | 2, 9–11, 18, 20–23, 25, 27, 30, 35, 37–38, 40 | 9–11, 87, 114–122 |
| Principle 2: Best interests<br><br>Are children's best interests a primary consideration in policy and product design? | Best interests<br><br>Embed children's best interests in product development, design and policy | 3(1) | 12, 13, 88 |
| Principle 3: Consultation<br><br>Are children meaningfully consulted in developing your policy or product? | Consultation (right to be heard)<br><br>Engage and listen to the views of children in product development, design and policy | 12 | 16–18 |
| Principle 4: Age appropriate<br><br>Is your policy or product appropriate for child users or adaptable for children of different ages? | Age appropriate (evolving capacity)<br><br>Develop policies and products that are age-appropriate by design and consider using age assurance | 5, 18 | 15, 19–21, 84–86 |
| Principle 5: Responsible<br><br>Do you review and comply with laws and policies relevant to child rights? | Responsible (general measures of implementation)<br><br>Comply with legal frameworks, provide remedies as needed and | 4, 42 | 22–27, 33, 35–39, 43–49, 123–124 |

| | conduct a Child Rights Impact Assessment | | |
|---|---|---|---|
| Principle 6: Participation<br><br>Does your policy or product enable children to participate in digital publics? | Participation (civil rights and freedoms)<br><br>Enable children's participation, expression and access to information | 7, 8, 13–15, 17 | 50–66, 79 |
| Principle 7: Privacy<br><br>Have you adopted privacy-by-design in policy and product development and use? | Privacy (and data protection)<br><br>Embed privacy-by-design and data protection in policies and product development and use | 16 | 67–78 |
| Principle 8: Safety<br><br>Have you adopted safety-by-design in policy and product development and use? | Safety (protection from violence and sexual harm)<br><br>Embed safety-by-design in policies and product development and use | 19, 34, 39 | 80–83 |
| Principle 9: Wellbeing<br><br>Does your policy or product enhance rather than harm children's mental or physical health and wellbeing? | Wellbeing (life, survival, health and disabilities)<br><br>Enhance and do not harm the health and wellbeing of all children, including through the use of inclusive design | 6, 23, 24, 26, 27, 33 | 14, 89–98 |
| Principle 10: Development<br><br>Does your policy or product enable children's learning, imagination, play and belonging? | Development (education, play, cultural activities)<br><br>Enable children's learning, free play, sociability and belonging, and their fullest development | 28–31 | 99–111 |
| Principle 11: Agency<br><br>Have you taken steps to reduce compulsive and exploitative product features? | Agency (economic exploitation)<br><br>Support child users' decision-making and reduce exploitative features and business models that harm their agency | 32, 36 | 40–42, 112–113 |

*Source: Digital Futures for Children*

# Appendix 5: Initiatives for children's rights

| No. | Publication name | Organisation & year of publication | Intended use |
|-----|------------------|-----------------------------------|--------------|
| 1 | Safety by Design | Australian Office of the eSafety Commissioner (2019) | *For digital developers*, to incorporate, evaluate and enhance user safety. |
| 2 | Digital Connectivity: A Transformative Opportunity | Broadband Commission (2023) | *For monitoring the global progress* on universal connectivity and the achievements of broadband advocacy targets*. |
| 3 | Handbook for Policymakers on the Rights of the Child in the Digital Environment | Council of Europe (2020) | *For policymakers* in political and strategic decision-making concerning the provision of digital products and services used by children and young people and related practices. |
| 4 | Guidelines to Respect, Protect and Fulfil the Rights of the Child in the Digital Environment: Recommendation CM/Rec (2018)7 of the Committee of Ministers | Council of Europe (2018) | *For governments of member states and digital developers*, to fulfil respective responsibilities towards children's rights. |
| 5 | EU Strategy on the Rights of the Child | European Commission (2021) | *For the European Commission and member states*, to take actions identified in the strategy to protect, respect and fulfil children's rights. |
| 6 | Common Framework of Reference on Child Rights Impact Assessment: A Guide on How to carry out CRIA | European Network of Ombudspersons for Children (ENOC) (2020) | *For ENOC member states and other public authorities* in decision-making and practices concerning laws, policies, budgets, programmes and services. |

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| 7 | [EU Children Participation Platform](#) | European Union (2024) | *For children in the EU* to have their say on matters important to them. |
| 8 | [EU-UNICEF Child Rights Toolkit: Integrating Child Rights in Development Cooperation: Module 5 Child Impact Assessments](#) | EU and UNICEF (2014) | *For governments, development organisations and their partners* (e.g., EU, OECD, UNICEF and World Bank) in policymaking, decision-making and project planning. |
| 9 | [Council Working Group on Child Online Protection (COP)](#) | ITU (2024) | *For member states, especially developing countries*, to build capacity for developing and implementing roadmaps for child online protection. |
| 10 | [Responsible Innovation in Technology for Children (RITEC)](#) | Joan Ganz Cooney Center (2024a) | *For digital developers*, to engage with the RITEC framework, and advocate and design for children's wellbeing. |
| 11 | [Well-Being by Design Fellowship](#) | Joan Ganz Cooney Center (2024b) | *For designers and producers of interactive technology and media for children*, to develop expertise in designing for children's best interests and wellbeing. |
| 12 | [Recommendation of the Council on Children in the Digital Environment](#) | OECD (2021c) | *For public and private organisations involved in setting policies and practices or providing digital services for children*, to create a safe and beneficial digital environment for children. |
| 13 | [Guidelines for Digital Service Providers](#) | OECD (2021b) | *For digital developers*, to take the safety-by-design approach to address online risks. |
| 14 | [The African Union Child Online Safety and Empowerment Policy](#) | The African Union (2024) | *For all stakeholders, including States, digital developers and other relevant actors*, to protect, respect and fulfil children's rights, thereby making the digital environment safer for children. |
| 15 | [Child Rights and Wellbeing Impact Assessment External Guidance and Templates](#) | Scottish Government (2019) | *For Scottish Government officials and public authorities* in policy and public decision-making processes. |

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| 16 | UNESCO's Internet Universality Indicators: A Framework for Assessing Internet Development | UNESCO (2019) | *For interested parties (e.g., international organisations driving internet development)*, to assess and monitor global internet development. |
| 17 | Gateways to public digital learning | UNESCO & UNICEF (n.d.) | *For countries worldwide*, *to* establish and improve public digital learning platforms. |
| 18 | Children's Rights in Impact Assessments: A Guide for Integrating Children's Rights into Impact Assessments and Taking Action for Children | UNICEF and the Danish Institute for Human Rights (2013) | *For businesses* in assessing their policies, operations and processes. |
| 19 | Mobile Operator Child Rights Self-Impact Assessment Tool (MO-CRIA) | UNICEF (2016b) | *For mobile operators* in assessing the impact of corporate practices, policies and processes on child rights. |
| 20 | Tools and resources | UNICEF (2019) | *For digital developers*, to assess and mitigate the adverse impact of their products and services on children and their rights. |
| 21 | The children's rights-by-design standard for data use by tech companies | UNICEF (2020) | *For technology companies*, to protect, respect and fulfil children's rights, focusing on companies' data practices. |
| 22 | Online Gaming and Children's Rights: Recommendations for the Online Gaming Industry on Assessing Impact on Children | UNICEF (2020) | *For digital developers in the gaming industry*, to advance diversity equity in their products and services. |
| 23 | Policy guidance on AI for children | UNICEF (2021) | *For policymakers, parents and children*, to anticipate and manage the impact of AI systems on children and their rights. |
| 24 | Responsible Innovation in Technology for Children: Digital Technology, Play and Child Well-Being | UNICEF-The LEGO Foundation (2022, 2024) | *For digital developers*, to develop digital technologies that promote children's wellbeing. |

| 25 | Child Rights Impact Assessments in Relation to the Digital Environment | UNICEF (2024) | *For digital developers*, to assess and address the impact of their digital products and services on children and their rights. |
|---|---|---|---|
| 26 | RITEC Design Toolbox | UNICEF – The LEGO Foundation (2024) | *For digital developers*, to design and develop digital play for children's wellbeing. |
| 27 | Global Digital Compact | United Nations Office of the Secretary-General's Envoy on Technology (2024) | *For world leaders*, to agree on the global governance of digital technologies and AI grounded in human and children's rights. |
| 28 | Children's Rights Scheme 2014: Arrangements for having due regard to the United Nations Convention on the Rights of the Child (UNCRC) when Welsh Ministers exercise any of their functions | Welsh Government (2014) | *For the Welsh Government* in public decision-making and policy development processes. |
| 29 | Digital Technologies in Education | World Bank (n.d.) | *For developing countries worldwide*, to provide access to education through effective and appropriate use of information and communication technologies (ICT). |

# Digital Futures
# For Children

Research at LSE and 5Rights Foundation ∎

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