Analysis and modelling of socio-environmental impacts of Corporate Digital Responsibility

Aiste Rugeviciute[1,2]

[1]*La Rochelle University, Technoforum, 23 avenue Albert Einstein, BP 33060 - 17031 La Rochelle - France*
[2]*Square Research Center, 173 avenue Achille Peretti, 92200 Neuilly-sur-Seine - France*

Abstract
Worldwide there has been an increasing pressure on organizations to address sustainable development issues. Given the pervasive nature of Information and Communication Technologies (ICT), managers are confronted with a quandary over how to make responsible strategic decisions and take into account the economic, environmental, and social effects of technologies. This PhD research investigates the impacts of strategic sustainable ICT decisions, falling under Corporate Digital Responsibility (CDR) topic. The project aims at defining a mathematical model that can help organizations to anticipate the effects, both positive and negative of their CDR strategies to the environment and society. This research contributes to both theory and practice by advancing an emerging debate around the new concept of CDR, which aims to guide an organization's operations in order to foster an ethical and responsible development, deployment and usage of ICT.

Keywords
Corporate Digital Responsibility (CDR), ICT for sustainability (ICT4S), Sustainable development, Digital transformation, Decision-making

1. Context & Motivation

1.1. Governing ICT in the context of sustainable development

Digitalisation is associated with high hopes to achieve sustainable development goals [1, 2]. European Commission states that: "Digital technologies could play a key role in achieving climate neutrality, reducing pollution, and restoring biodiversity" [3] and in the United Nations Sustainable Development Goals, ICT[1] is mentioned as being a key in advancing 4 goals [4]. Yet, along with the benefits of digital transformation come negative impacts to the environment and society which can nullify or even outweigh the positive outcomes, such as contribution to greenhouse gas emissions or data bias [5, 6]. The research network "Digitalisation for Sustainability" (D4S) argues that current market forces in the digitalisation landscape rather perpetuate over-consumption patterns. In order to change this, strategies have to be aligned

[1]In this project "ICT" is used interchangeably with terms "digital technology" and "IT" in order to refer to all digital information and communication technologies.

with a broad vision of leveraging digital technologies to promote sustainable living within our planet's boundaries for all individuals [7].

It is in this context that organisations face new challenges in governing their digital activities – *how can they minimise the negative effects of ICT and of related digital activities and to maximise the positive ones to the environment and society?* The ICT research community has also been urged to further incorporate and investigate the impact of digital technologies and their significance in the decision-making of sustainable development strategies [8, 9, 10].

Aiming to respond to these challenges, a new field of Corporate Digital Responsibility (CDR) emerged, seeking to guide organisations in their attempts *to ensure an ethical and responsible development, deployment, and use of digital technologies and data* [11, 12].

1.2. The Emergence of Corporate Digital Responsibility

One of the first occurrences of the term *Corporate Digital Responsibility* can be traced back to an Accenture report of 2015 [13]. Despite the early stages of the academic engagement with this concept, it has been popularised in the corporate world [14, 15, 16, 17] and is perceived as an increasingly important subject for all economic actors in the realization of their sustainable development policies [6, 18].

If ICT for Sustainability (ICT4S), based on Hilty and Aebischer [19] definition, can be considered as a sustainable development equivalence applied to the digital realm, CDR can be compared to Corporate Social Responsibility (CSR)[18, 11, 20]. Within the field of CSR there are different guidelines and methods enabling organizations to develop their CSR strategies [21]. However, in the field of CDR such guidelines, frameworks or standards do not exist yet. Lack of methodologies supporting sustainable decision making when it comes to the development, usage and deployment of ICT by organizations hurdles the adoption of ICT4S principles within organisations.

The main ambition of this project is, thus, to advance the construction of decision-making methods which would integrate the socio-environmental effects of ICT. In this vein, this project aims to contribute to a larger question of *how organizations can use CDR as a migration path to become better aligned with their sustainable development strategy*. With this in mind, it pursues two main objectives as described in the next section.

2. Objectives of the Project

The first objective of this project is to contribute in addressing the question which was raised by Lobschat et al. [18, p. 12]: "How should we capture and assess an organization's CDR readiness and degree of CDR implementation?". Building on existing work around CDR, as well as other related scientific fields, such as Green Information Systems (IS), this work seeks to propose a framework to delineate the scope of CDR and to conceptualize strategic *CDR decisions* - ICT decisions considered to be responsible and in line with sustainable development principles. In this vein, this project aims to contribute to debates about CDR relation to CSR and about the perimeter of CDR.

Secondly, through mathematical modelling, I seek to contribute to the construction of methods enabling organizations to make better informed decisions when building their CDR strate-

gies. I pursue to establish methods which allow to assess a link between CDR decisions and socio-environmental impacts. The existing scientific literature examines ICT impacts on the environment or society, and proposes theoretical implications of adopting Green IS practices. However, to my best knowledge, to date no study attempted to model the socio-environmental impacts resulting from CDR decisions. Yet, successful adoption of CDR hinges on an organizations' ability to identify strategic decisions that will help them to generate the greatest positive socio-environmental impact in a context-specific scenario.

3. Background and Related Work

3.1. Theoretical foundations of CDR

Questions surrounding digital responsibilities and risks are not unique to the CDR community - other research communities have been grappling with them for decades. Mueller [12] posits that the conceptual roots of CDR lie within business ethics, CSR and computer ethics. A further shift in recognition that organizations have a responsibility to mitigate the negative impacts of digital products and services they make, design, use, and deploy extends to ICT4S and related research communities. Green IS community, for example, has proposed various frameworks and best practices to guide organisations in their strategies to mitigate the negative environmental impact of digital products and services [22, 23, 24, 25]. Discussions of digital risks and opportunities and the role that companies should play in aligning them with sustainability strategies are also found in other more specialized research communities, such as sustainable and ethical AI [26, 27, 28] or sustainable human-computer interaction (SHCI) [29].

Corporate Digital Responsibility hence finds itself at the intersection of research on business ethics, sustainable development and impacts of ICT.

3.2. Limitations of the current academic debate

Reflecting the fact that CDR research is still in its infancy, the current literature around CDR mostly discusses the fundamental concepts and factors enabling CDR implementation, such as motivations, barriers, readiness and awareness of CDR within organisations (Table 1). Scholars discuss the reasons *why* organisations need to address different digital risks [18, 30], however a limited literature attempted to structure and identify *what* those risks are. Herden et al. [6] provided the first attempt to classify the digital risks for organisations based on ESG framework, which is primarily a risk management and investment tool, that seeks to assess the financial risks that environmental, social, and governance factors pose to the value of a company. Dörr [4] has undertaken a similar exercise and identified 15 "undesirable side effects of digitalisation" and introduced their corresponding responsibility "clusters" of CDR. Other scholars have covered a consumer-only oriented issues [31, 11] or mentioned a number of topics of what CDR should cover without going into further details [32, 33, 34]. This work thus remains to be consolidated in order to establish common reference points to advance the theoretical and practical debate in how CDR can help to address the new digital challenges in the context of sustainable development.

Table 1

CDR literature review: categorisation by adoption phases as proposed by Laranja Ribeiro et al. [37]

Phase	Discussion topics	Literature
Pre-adoption *(what and why)*	1) Definition	1) [11, 6, 31, 33, 4, 18, 38, 32, 20]
	2) CSR vs CDR	2) [18, 32, 11, 39, 40, 33, 20, 36]
	3) Dimensions of CDR	3) [6, 4, 33, 41, 34, 11, 30, 31]
	4) Motivating factors	4) [4, 32, 33, 42, 43, 18, 35, 11, 38, 34, 44, 45, 30, 46]
	5) Barriers to adoption	5) [4, 42, 45, 30]
	6) CDR Readiness	6) [4]
	7) CDR Awareness	7) [45]
Adoption *(how)*	1) CDR culture	1) [39, 32, 18]
	2) Focus on data	2) [31, 40, 47, 43, 44, 20]
	3) Focus on AI	3) [39, 32, 35, 45, 30]
	4) CDR practices	4) [47, 32, 33, 18, 35, 45, 30]
	5) Process models, frameworks	5) [4, 6, 18, 46, 30]
Post-adoption *(so what)*	1) Benefits for business	1) [4, 43, 44, 45, 6]
	2) Metrics, Indicators	2) [4]
	3) System wide challenges	3) [4, 20, 42]

Yet fewer studies attempted to propose concrete practices and guidelines for CDR adoption, and to address the question of *how* to put CDR in practice. Some studies highlighted the way CDR could be implemented in a particular digital technology scenario, such as AI [32] or data management [35]. Other scholars suggested theoretical conceptualisation regarding CDR implementation [6, 18, 30], however there is a lack of empirical studies and methodologies which would accompany decision making process and governance with respect to CDR [36]. The development of such guidelines or frameworks for CDR is constrained by the lack of a common understanding of the scope of CDR.

3.3. Impacts of CDR practices

An extensive literature attempted to propose frameworks to analyze different types of impacts of ICT [48, 49, 19, 50, 51] and methodologies to measure them [5, 52, 53, 54]. To date, however, a limited literature attempted to propose methods to analyse the impacts to society and to environment resulting from CDR practices within organisations. Green IS community have proposed different maturity frameworks which allow to demonstrate ICT contribution in supporting a company's environmental sustainability strategy [25, 55]. However, to my best knowledge no attempt has been done in trying to model the potential socio-environmental impacts of CDR strategies.

4. Research Methods

4.1. Objective 1: Creation of a conceptual framework to assess an organization's degree of CDR implementation

In 2010, Harmon et al. argued that the sustainability of digital technologies should be driven by CSR [56]. Most of the current literature reasons that, even if CDR merits a separate attention due to the pervasiveness of technologies and their unique nature [18, 20], CDR could benefit from existing CSR tools and knowledge [31]. In this vein, I propose to use a CSR tool and relevant literature review to establish the scope of CDR. The developed method will be tested within the industry and feedback will be gathered from practitioners in the field in order to improve it and test its pertinence. However, if such a model may allow for organizations to assess their degree of CDR implementation, it is only the first step in constructing a methodology which would empower organizations to design an impactful CDR, according to their strategy and positioning.

4.2. Objective 2: Development of a mathematical model to anticipate socio-environmental impacts of CDR practices

Therefore, the second objective of this research is to develop a mathematical model that can help anticipate the effects, both positive and negative, resulting from CDR strategies to the environment and society.

Considering the early stage of my research, I have not settled yet regarding the methodology to be used in order to define links between CDR practices and impacts. Building a model from reality is always an abstraction which, in the case of this project, will be affected by the complex nature of both ICT and sustainable development as well as by the existing uncertainty due to my imperfect knowledge of the world. To address such problems, a few studies have employed multiple attribute decision making (MADM) methods to estimate the overall effects of ICT on sustainability and to facilitate decision-making process for organizations and policy makers [57, 58]. A combination of MADM with other statistical techniques, such as sensitivity analysis, could allow to deal with incomplete and uncertain information [59]. This literature review remains to be extended in order to identify the right approach for modelling the impacts of CDR strategic decisions which in turn would help to make better informed decisions for organizations within their sustainable development strategies.

5. Dissertation Status

Being in my first year of PhD, I am still at the stage of exploring the potential methods to achieve the goals of the project. After having performed the literature review regarding the CDR and related research fields I was able to identify gaps in the existing literature and position my research with respect to the larger ICT4S landscape. Following the literature review and discussions with other researchers in my company, I have chosen a CSR tool - European Sustainability Reporting Standards (ESRS)[60], in order to propose a structure for the scope of CDR. Based on a diverse literature analysis, I identified digital sustainability matters that concern impacts to people or the environment, resulting from an entity's digital activities. The

results have been submitted to two conferences in order to discuss them with a larger academic community.

Establishing dimensions of CDR and structuring the perimeter of CDR was a necessary step to advance in my research. The next stage is to identify methods which could serve in developing a methodology allowing to establish links between CDR practices and the aforementioned CDR dimensions. For this purpose and due to the interdisciplinarity of my research I am currently exploring literature from different academic fields, such as Green IS, econometrics, machine learning, CSR and management studies.

6. Advice sought

While feedback on the overall structure of my project would help me to grow as a researcher and would support me in producing quality research, I would be especially curious to benefit from expert advice regarding my second objective: development of a methodology to model socio-environmental impacts of CDR practices. Due to the novelty of CDR, there is a lack of historical observations and data which could be used to quantify the impacts using the traditional statistical methods. I believe that the interdisciplinary nature of ICT4S conference could help me to identify ways how to overcome this barrier in my research.

I am grateful to benefit from the knowledge of La Rochelle University where I am performing my Informatics and Applications PhD in the L3i laboratory. My project proposal has also been accepted under the French CIFRE scheme which means that I am working with an industry. Being employed by Square Management consulting company, I can benefit from access to the field and the resources of their Research & Development department. However, since the nature of my subject is not a purely computer science subject and it has overlaps with other academic fields such as management studies, sometimes I feel challenged to navigate between multiple disciplines. An advice and feedback from ICT4S community on this question would be very appreciated.

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