

# In Search of a Thematic Framework for Teaching Sustainable and Responsible Digitalization

Veikko Halttunen<sup>1,†</sup>, Stephan Schlögl<sup>2,\*,†</sup>

<sup>1</sup>University of Jyväskylä, Jyväskylä, Finland

<sup>2</sup>MCI – The Entrepreneurial School, Innsbruck, Austria

## Abstract

Sustainability and responsibility have become increasingly crucial in education. This action research study thus aimed to develop a comprehensive framework for teaching sustainable and responsible digitalization at the university level, addressing the often-overlooked threats and disadvantages of digital transformation. Current optimistic perspectives frequently neglect critical aspects necessary for responsible digitalization. Our framework shifts focus to these threats, identifying key responsibilities for developing future digital systems. The research process involved iterative literature reviews and practical implementation through university courses, refining the framework based on student feedback and evolving themes. As such the framework is meant to guide the instruction of sustainable and responsible digitalization, with potential broader applications in developing digital systems, assessing corporate responsibility, and informing policy-making. In summary, we emphasize the need for a holistic approach to address the multifaceted challenges of digitalization for planetary well-being.

## Keywords

Digital Systems, Sustainable Digitalization, Information Systems Education, Responsibility Education, Thematic Teaching Framework

## 1. Introduction

Digital systems have become crucial to modern societies. Over the past decade, platform and data economies, as well as other IT-based trends such as the Internet of Things (IoT), blockchain technology, and generative artificial intelligence (GenAI), have significantly transformed everyday lives [1]. All these changes may be subsumed under the umbrella often referred to as *digital transformation*. Such trends, however, are also intertwined with a major societal challenge, i.e., the ongoing change in climate and the resulting loss in biodiversity [2, 3]. Climate change, which threatens to lead to an ecological catastrophe, forces us to think beyond single digitalization projects and rather consider its overall global benefits and harms. To this end, it has also been understood that environmentally responsible operations are linked to many other responsibility issues, such as social equality or inclusion, which implies that responsibility cannot be reduced to individual solutions that, on the one hand, may promote responsibility in some aspect, but, on the other hand, make operations more irresponsible concerning other aspects. Still, the mainstream research literature has viewed digitalization rather unilaterally as a great opportunity, while the examination of potential disadvantages and threats has been rather superficial and fragmented. Nevertheless, the importance of a critical perspective when examining the development of digital transformation has been recognized [4].

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\*Corresponding author.

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✉ veikko.halttunen@jyu.fi (V. Halttunen); stephan.schloegl@mci.edu (S. Schlögl)

ORCID 0009-0003-5370-6648 (V. Halttunen); 0000-0001-7469-4381 (S. Schlögl)



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**Figure 1:** UN Sustainable Development Goals. Online: [https://en.wikipedia.org/wiki/Sustainable\\_Development\\_Goals](https://en.wikipedia.org/wiki/Sustainable_Development_Goals) [Accessed: 16 June 2025]

A shift towards more comprehensive responsible actions needs to start with building an awareness and understanding of the fundamentals of responsibility. In this respect, education at various levels plays a key role, and thus our goal was to contribute to this field by exploring the following research question:

*What are themes and content units on sustainable and responsible digitalization to be taught in modern information systems education?*

Following, we present the initial phases of this research agenda. Starting from a critical perspective, our goal was to uncover the threats and pitfalls that prevent the realization of responsible digitalization. Such was conducted as an action research study, which aimed to yield a first thematic teaching framework. We present the key concepts of this undertaking in Section 2 and describe its methodological implementation in Section 3. Then, we discuss the main findings from each phase in Section 4 and present our thematic teaching framework in Section 5. Finally, Section 6 will close our report with some concluding remarks.

## 2. Key Concepts

We define *sustainability*, *responsibility* and *digitalization* as the key concepts around which our envisioned teaching framework should be built.

### 2.1. Sustainability

The concept of sustainability has been in use in its current form for almost 40 years. It became more widely known through the 1987 *Brundtland Commission Report of the World Commission on Environment and Development on our Common Future*<sup>1</sup>. At that time, sustainability was primarily discussed as sustainable development. The starting point of the Brundtland Commission's work was the concern about the destruction of the environment as a result of human activities. Thus it emphasized the sustainable coordination of economic and environmental goals and measures in such a way that meeting the needs of current generations does not compromise the needs of future generations. This was considered to require a clear intervention to the environmental challenges identified at that time. The most comprehensive set of sustainable development goals has since been defined by the United Nations by their *Sustainable Development Goals* (usually referred to as SDGs). Those contain 17 main objectives that aim to achieve economic, social and environmental sustainability (cf. Figure 1). In that, the SDGs cover a wide range of factors related to the well-being of individuals, societies and the environment. As the most controversial of these goals may be seen goal number eight, i.e. *Decent Work and Economic Growth*, as the negative impact an ever growing economy may have on the environment

<sup>1</sup>Online: <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf> [Accessed: 16 June 2025]

has already been recognized in the groundwork of the Brundtland Commission. That is, business models, even those that may be considered environmentally friendly, can waste natural resources and thus cause the degradation of nature. Consequently, we have decided to excluded the economic growth component from our guiding principles for now. This does not mean that we do not consider the development of sustainable business models as important. Rather, we believe that sustainability should initially be discussed outside economic boundaries. All the other SDG goals, however, have been included into our analysis.

## 2.2. Responsibility

Responsibility has often been seen as a synonym for sustainability. However, the difference between the terms is evident in their concreteness. Whereas sustainability sets the target for human activities (cf. SDGs in Figure 1), responsibility relates to obligation and accountability [5]. Ethical and moral considerations are also associated with responsibility. Thus, although sustainability and responsibility may be seen as reflecting the same field of phenomena, the concept of sustainability has two clear shortcomings compared to the concept of responsibility. First, as we noted earlier, responsibility creates a better foundation for concreteness, which is why it may be better for educational contexts. Second, sustainability is often perceived as a matter specifically related to environmental problems. Responsibility, however, is broader and can therefore more easily cover areas related to information systems education.

## 2.3. Digitalization

Digitalization, which today is often referred to as *digital transformation*, shapes the operations of individuals, organizations and society through the opportunities offered by digital systems [6]. As such it is a pervasive and all-pervading process of change that is visible in everyone's daily life. Digitalization has also been considered one of the key means by which climate change may be mitigated [7], for digital transformation and green transition are meant to go hand in hand [8]. Although there is a growing number of studies and statements that point to potential threats of digitalization (e.g. [9, 10, 11, 12, 13]), there is still relatively little attention paid to negative impacts, such as the energy consumption and consequent generation of  $CO_2$  emissions by the rapidly growing IT infrastructure (e.g., data centers), the poor recycling rate connected to electronic devices, the increasing consumption of rare minerals, or the negative side-effects digitalization may have on people's physical and psychological well-being.

## 3. Methodology & Research Process

Action research is ideally suited to situations where research is used to develop teaching practices [14]. Cohen & Manion (ibid.) define action research as "*a small-scale intervention in the functioning of the real world and a close examination of the effects of such an intervention*". Action research combines theory and practice, and it is iterative and reflective in nature [15]. In our case, the researcher and the practitioner (i.e., the teacher) are the same actors, for which we can define the process as self-reflective. The students have naturally participated indirectly in the process by completing the course and providing feedback. The people involved in curriculum planning, with whom discussions have been held about the course content, can also be considered parties in the research process.

We started our project in Spring 2023, by teaching a new topic to our Information Systems students: *Sustainable and Responsible Digitalization*. Although there was already a lot of 'buzz' around this topic at the time, it was still rather difficult to build an overall picture of what should be included in such a course. Thus, we decided to create a thematic framework that could be utilized widely in teaching responsible digitization, especially for information systems students. This led to a process combining action and research, during which the framework was gradually developed. We describe the phases of this process in more detail below.

### 3.1. Phase 1: Initial Literature Review

In the first phase the aim was to find suitable content for a summer course at the University of Jyväskylä. The course should be worth 2 credits, thus we had to focus on the most important topics only. The task began with a literature review, initially employing the search terms “*responsible*”, “*sustainable*” and “*digitalization*”. Subsequently, the search was expanded to include derivatives of the previous search terms, such as “*responsibility*”, “*sustainability*”, and “*digital system*”. This led to a number of key themes that had to be covered by our 2023 summer course. While this completed our initial literature analysis, scanning for applicable scientific work continued throughout the entire research process. The most important results of this iterative scanning are described separately for each phase of the process, emphasizing the contribution of the selected articles to the building and validating of our framework.

### 3.2. Phase 2: Summer Course

The summer 2023 course consisted of three lectures. It did not have any exams, but to successfully complete the course, students had to write an essay on one of the topics from the responsible digitalization topic areas. There were several options for each topic area available, covering the relationship of digitalization with (1) the *Environment*, (2) *Information Security and Privacy*, (3) *Well-being and health*, and (4) *Digital Divide*. All topics were based on the aforementioned literature review and considered to be equally important, although emphasis was given to the first theme. In addition to writing the essay, students had to participate in a colloquium that was organized at the end of the course, where the key content of the course was discussed in more detail. The colloquium was open to everyone and was also attended by the course lecturers, the dean of the faculty, and an expert whose expertise was focused around environmental issues, especially around carbon footprint assessments.

### 3.3. Phase 3: Framework Development, Implementation & Review

At the end of the summer course, respective experiences were analyzed and integrated into an initial framework out of which a curriculum for a 5 credit course was formed. The goal was for such a course to become mandatory for all bachelor students of information systems science. Yet, before the course was implemented at our university, it was offered as an applied course for the service sector at a befriended University of Applied Sciences. This implementation provided additional valuable information about the general usability of the overarching thematic framework and helped develop it further.

Eventually in spring 2025, the course was implemented at University of Jyväskylä as planned, and also here the suitability and comprehensiveness of the themes were assessed after its initial implementation.

## 4. Discussion of Findings

The first task was to form a comprehensive understanding of scientific literature that deals with sustainable and responsible digitalization. Although the literature review was conducted as systematically as possible, its primary goal was to find core material for the course, not to carry out a systematic literature study. Thus, there were no strict inclusion or exclusion criteria. Instead, sources were reviewed individually from the perspective of both relevance and quality. A detailed discussion of the results of this phase are described in Halttunen, 2023 [16].

As already outlined earlier, there were four themes that emerged from the literature review: (1) *Environment*, (2) *Privacy and Information Security*, (3) *Well-being and Health*, and (4) *Digital Divide*. Of these themes the first one, i.e., environment, received most of the attention, whereas the other three themes were given equal weighting. Here, discussed topics include the amount of raw material and energy ICT consumes at different stages of its life cycle and how this causes GHG (=green house gas) emissions, recycling problems as well as other environmental problems caused by production of ICT.

## 4.1. Initial Theme Selection & Course Feedback

Initially, the 2023 summer course had already included themes at four different levels: individual, organizational, societal and the biosphere. While the latter may directly only be related to the environmental theme, it is indirectly (from the perspective of planetary well-being) also linked to the other themes [17, 18]. And thus it was decided to keep it in even after the summer course had ended.

Looking at the essays written during the summer course, students covered a wide range of topics. Since they were given the choice to select their topic from a predefined list of topic candidates, their selection was also seen as a reflection of their interest, which, to some extent, also played a role in developing the direction of the thematic framework, although the principal focus of the development was naturally on research-based factors. Eventually, however, as the theme distribution was very broad among students, it was decided to include all of them. And even more so, to give them all the same weight in the curriculum

Finally, to further support the theoretical analysis, new sources were found not only for each relevant themes to be included but also for the building of the framework. Particularly, the work of Trier et al. [19] deemed instrumental.

## 4.2. Expanding the Field

During the time when the lessons learned from the summer course were evaluated and the curriculum for the 5 credit course was developed, we were unexpectedly given the chance to also implement a respective course at a befriended university of applied sciences. We considered this as a good opportunity to test the functionality of the thematic framework in a more applied setting. Both the planned university course and the course to be implemented at the university of applied sciences had to worth 5 credits. The main difference between the two courses, however, was that the university course was aimed specifically at students in the IS field, while the course at the university of applied sciences was aimed at students in the service sector. We did not consider this to be a major problem, since the themes of the course were broad enough so that they were applicable to different fields. However, as the students at the university of applied sciences were lacking technical knowledge on digital systems, it was decided to also include a short introduction unit covering the development of digitalization.

## 4.3. Additional Feedback

Based on the formal and informal course feedback, students of the service sector found the course content interesting, timely and thought-provoking. While individual responses raised challenges in understanding some aspects of the course, we believe that a sufficiently extensive introductory section addressing unfamiliar concepts related to digital systems, would easily alleviate this problem. As for the university course focused on information systems students, such additional content should not be needed. The literature review at this stage did not provide any new perspectives on the overall framework but rather deepened the existing perspectives and tied them more clearly to the specificities of the ICT sector.

As for the themes, we examined the coverage after the course was carried out at the university of applied sciences. All the themes in the course still seemed to be necessary, but a new theme had emerged during the post-evaluation which until then had been neglected: *“infrastructure vulnerabilities”*. While the importance of this theme may be partly increased by the prevailing world political situation, its necessity also emerged from the course content. That is, the functionality of the basic infrastructure is not only a key part of information security and privacy protection, but it is also considered essential for, e.g., the continuity of services provided by society and the prevention of inequality. Thus, we decided to add this theme to the content of the university course. Finally, the fourth theme in our theme list, i.e., *Digital Divide*, was renamed into *Inclusion and Inequality*. Although digital divide is a commonly known concept in scientific literature, we concluded that the concept pair of *inclusion* and *inequality* would be easier for students to understand, and it would also better describe the socio-technical and societal changes related to digitalization.

Sustainable and Responsible Digitalization	Key Content to be taught
(1) Introduction	Basic concepts (digitalization, digital transformation, sustainability, responsibility); development of information technology and digital systems; introduction to the themes;
(2) Environment	Lifecycle model (production, use, disposal/recycling) for analyzing the impacts of digital systems on environment (use of raw materials, energy consumption, GHG emissions, other impacts like water pollution and use of clean water); risks of mining; risks of material unavailability and rebound effects; examples of irresponsible digitalization;
(3) Privacy and Data Security	Privacy as a fundamental right; legislation (GDPR, national laws etc.); basic concepts (information privacy/data protection, data security); privacy threats (data economy/surveillance capitalism, government surveillance and espionage, cybercriminals, white hat hackers (sic!), unethical use of cookies and terms of use, dark design patterns); examples of irresponsible (unethical) and responsible use of digital systems, and of fatal failures of data security;
(4) Health and Well-being	Technostress; problematic smartphone use; addictions and disorders (e.g. internet addiction disorder, internet gaming disorder); sleeping problems; physical health problems; problems at school (e.g. concentration disorder, cyberbullying) and problems in social relationships; examples of irresponsible/responsible digitalization;
(5) Inclusion/Inequality	Basic concepts (digital divide, inclusion, participation); three levels of digital divide; the effects of circumstances and individual factors on the formation of inclusion; societal, and societal strategies and actions to promote inclusion;
(6) Vulnerabilities of Infrastructure	Basic concepts (infrastructure, basic infrastructure, vulnerability, resilience); the constituents of basic infrastructure; vulnerabilities and interdependency of power grid and telecommunication networks;

**Table 1**

Themes for a Course on Sustainable and Responsible Digitalization and Key Content to be taught.

The two most important sources found at this phase were Duboc et al. [20] and Jiménez et al. [21].

#### 4.4. Course Implementation

When the course was eventually implemented at the University of Jyväskylä in spring 2025, our thematic framework included the following themes: (1) *Environment*, (2) *Privacy and Data Security*, (3) *Well-being and Health*, (4) *Inclusion and Inequality*, and (5) *Vulnerabilities of the Infrastructure*.

#### 4.5. Final Feedback

Based on the course feedback, the themes were perceived to be interesting, and the course progression was considered consistent. During the course, we noticed that in addition to the already exiting introduction lecture, it would be helpful to include one more lecture on the principles of ethics, as teaching responsibility without a basic understanding of ethics and moral felt difficult and unbalanced. This need for a brief introduction to ethics and moral is supported by the fact that in the IS field these concepts are often missing in bachelor curricula. Initially, we thought that ethics and moral could be

Possible Areas of Use	Purpose of Use
Teaching	Planning course content; evaluating responsibility aspects in courses that do not specially concentrate on responsibility (e.g. programming, IS development, digital service design); planning of future curricula;
Developing new Digital Systems	Analyzing a digital system's lifecycle effects on environment, privacy, users' health and well-being, and inclusion/participation/inequality;
Improving digital Responsibility	Analyzing a business model's lifecycle effects on the environment (putting specific emphasis on rebound effects), privacy, users' health and well-being, and inclusion/participation/inequality;
Policy Making	Considering necessary regulation for new digital businesses and digital systems;

**Table 2**  
Possible Utilization of the Framework.

seen as a built-in feature of responsibility. While this may generally be a true assumption, achieving business goals and consumer rights can easily be conflicted. Therefore, it is important to discuss ethical choices when building a new digital system. Digitalization furthermore involves areas where ethics and morals play a crucial role. This includes, for example, the use of artificial intelligence in businesses.

Consequently, we decided to include the ethics of responsibility as a new *Introduction* theme in our thematic framework. It should cover the basic concepts of ethics and moral and how they are related to building technologies and business models. The final framework of themes and their content is described in Table 1.

## 5. Utilization of the Framework

The primary goal and purpose of our thematic framework is to structure the teaching of sustainable and responsible digitalization. As the framework is rooted in theoretical literature and has been further refined based on the feedback and experiences gained from several implementation rounds, we believe it can be considered a good aid to support lecturers in, but not limited to, information systems. It is, however, that it may only be considered a starting point and that further updating and continuous finetuning is needed.

In addition to its main purpose as a teaching guide, we believe the framework may also be used for at least three other purposes (cf. Table 2): (1) to build responsible digital systems, (2) to assess the digital responsibility of companies, and (3) to form policies for responsible digitalization.

The focus of developing digital systems has so far been on producing and contributing to commercial innovations. As awareness of the importance of digital responsibility increases, understanding all the dimensions of digital responsibility becomes a key goal. We therefore would like to emphasize that improving responsibility in digital systems should not be limited to individual dimensions. Rather, it is necessary to meet the responsibility requirements of all dimensions. Our framework adds value to this purpose.

When digital systems either form the basis of a business or constitute a significant part in it, digital responsibility of the business model need to be considered in the same way as it is when developing digital systems. Each responsibility dimension (called themes in our framework) must be examined. That is, one needs to account for both the direct effects and the indirect effects on consumers, companies and entire industries. Once again, what is essential for responsibility is not the improvement of individual parameters, but the overall effect. From a societal perspective, it is important to understand the key areas of sustainable and responsible. Our thematic framework may therefore be used to better understand and potentially improve the risks of digitalization and consequently help create more responsible digitalization programs.

## 6. Concluding Remarks

Input on sustainable and responsible digitalization should be central to all educational programs that include developing digital systems for businesses and public services. Along with the many benefits of digital systems, potential disadvantages and risks that may arise from such developments must be highlighted. Responsibility is above all about avoiding these risks. Companies that utilize digital systems in their new business models are therefore obligated to ensure that information technology is used in an economically profitable way, respecting the responsibility demands that come from consumers, societies and the living environment.

Such responsibility requirements may be derived from the concept of planetary well-being [22], which means that digitalization must be implemented in a way that (1) sufficiently and comprehensively regards the conditions for the well-being of the environment, human communities and individuals, and that (2) respects the fact that related problems may only be solved by considering a holistic viewpoint.

This perspective differs somewhat from, e.g., the UN's sustainability goals as it weakens the emphasis on economic growth. Yet, if we look at the issue specifically from the perspective of how digitalization is taught in educational programs in the information systems field, we see that including economy in responsibility considerations is unnecessary. That is, in most information systems programs the economic benefits and respective utilization of digital systems are discussed extensively, while most sustainability solutions require compromises between economics and sustainability criteria. This emphasizes the importance of seeing sustainable and responsible digitalization rather detached from economic affairs.

Responsibility has a price. It can be assumed that short-term investments in responsibility significantly exceed short-term economic benefits. However, from the perspective of planetary well-being, ethically justified responsibility is an essential means for the survival of life [17]. Its long-term benefits are almost immeasurable in this sense. As critical responsibility aspects become an established part of education, it is evident that the relationship between responsibility and economy must be examined in an increasingly structured and explicit manner. We believe that our own thematic framework will add a small piece to this puzzle. Although it certainly requires additional adjustments and fine tuning, it might help in bringing this important topic to class room where it can be discussed and further developed.

## Declaration on Generative AI

During the preparation of this work, the authors used Google Translate and Gemini 2.5 Flash in order to translate and streamline the content. After using these tools, the authors reviewed and edited the content as needed and thus take full responsibility for the publication's content.

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