

Article

Synergies and Challenges: Exploring Organizational Perspectives on Digital Transformation and Sustainable Development in the Context of Skills and Education

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Abstract: The discourse surrounding digital transformation (DT) and sustainable development (SD) is pervasive in contemporary business and organizational operations, with both processes considered indispensable for sustainability. The success or failure of these endeavors hinges significantly on factors such as the behavior and skill sets of individuals within organizations. Thus, the purpose of the paper is twofold: to investigate the perceptions of organizations on digital transformation and sustainable development with regards to skills and education, and, secondly, to use the insights from these perceptions as a starting point for the use of systems thinking as a tool that could assist in achieving these states. To achieve the objective, a research effort was conducted that included desktop research, interviews with experts, and the development of a survey that was disseminated across Europe with questions on digital transformation and sustainable development. Finally, a general causal loop diagram was designed, illustrating the processes of digital transformation and sustainable development within organizations from a top-down view. The study reveals commonalities between DT and SD, recognizing both processes as advantageous with shared deficiencies in specific skill sets. It highlights a synergistic relationship between initiating DT and fostering SD activities. Furthermore, the research underscores the temporal aspects of these processes, acknowledging delayed positive effects and immediate implementation costs that challenge decision-makers to balance long-term benefits with short-term viability. In conclusion, the exploration emphasizes the dynamic nature of DT and SD, urging continual attention to the evolving landscape and the imperative for a shared understanding within organizational contexts.

Keywords: digital transformation; sustainable development; survey; perceptions; systems thinking; causal loop diagram



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1. Introduction

Digital transformation (DT) and sustainable development (SD) are two terms that dominate the discussion in the operations of businesses and organizations. Digital transformation is the application of automation and digitization to all aspects of an organization while sustainable development has been defined as the ability to satisfy needs without a detriment to future generations' ability to do the same [1,2].

These processes are not only considered fundamental for businesses and organization, but they appear indispensable in their effort for longevity and sustainability [3]. This is not limited to large corporations but includes Small and Medium Enterprises (SMEs), and public and private organizations in all economic areas. For example, in the construction industry, a driving economic force for every country, digital transformation is seen as a disruptive force [4], one, however, that its increasing adoption affects and improves productivity and efficiency [5].

Similarly, sustainable development, despite the vague nature of its definition, is constantly codified in national legislations as a necessary *modus operandi* of organizations. Pressure from the law, clients, and international treaties like the Sustainable Development Goals is making businesses consider the environmental and societal impacts of their operations [6].

Despite their complexity, both digital transformation and sustainable development are considered as vehicles for tremendous opportunities for success [7], but they are accompanied by great challenges and risks as well [8]. Among those are the lack of innovation and expertise, technical barriers and, most importantly, the lack of the necessary skills [9].

Furthermore, enterprises often perceive digital transformation as a risky endeavor. The World Economic Forum [3] identifies technological risks, such as cyber-attacks and data fraud, among the top global concerns, alongside environmental risks. These risks pose the potential for financial losses and significant damage to reputation. Therefore, it is crucial to enhance the digital and Information and Communication Technologies (ICT) literacy of both employees and managers.

Merely possessing the digital/computer infrastructure necessary for achieving digital transformation is insufficient. It is equally important to cultivate the ability to manage, integrate, and generate information. This, in turn, elevates ICT literacy. ICT literacy involves utilizing digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information, enabling effective functioning in a knowledge society [10].

In summary, while digital transformation holds the potential for success and sustainability, its achievement requires an organization to evolve into a learning entity. Becoming a learning organization is paramount, as it is the only organizational model positioned to thrive in the midst of digital transformation.

In a similar manner, the author of [11] in his research identified the risks associated with sustainable development. The managers interviewed expressed resistance to the notion of sustainable development and accompanying standards, citing a belief that the advantages of sustainability did not outweigh associated costs. Additionally, they argued that their in-house environmental systems fulfilled the same objectives. This hesitance can be linked to the broader challenge of sustainable development. This societal issue poses a dilemma for many firms, as they grapple with uncertainty regarding how to effectively respond.

To bridge this gap, there is a need for the institutionalization of sustainable development within the regulatory frameworks, societal norms, and prevailing mindsets of managers and employees. This can be achieved by translating the fundamental principles of sustainable development into tangible business practices, establishing more robust metrics for measuring sustainable development, and empowering and engaging employees. Through these initiatives, firms are more likely to adopt sustainable development as an integral aspect of their organizational activities.

Consequently, managers of businesses and organizations need to adopt a different mindset in order to achieve the desired digital transformation and sustainable development. This mindset needs not to rely solely on notions of linearity and equilibria, but to account for people's behavior. Finally, it should look not only in the future but also account for short-term gains and losses [12].

Systems thinking is a natural candidate for such an effort. It is a way of investigating the behavior of systems over time [13] using a top-down approach to represent them and reveal insights into how potential strategies could drive their functions. For that reason, it has been applied to industries and organizations to investigate how digital transformation and sustainable development can be achieved.

Sanchez [14] utilized systems thinking to explain managerial decisions for digital transformation; Von Kutzschenback and Brønn [7] developed a framework to represent the process at Uber, while Moellers et al. [15] worked similarly within the BMW

industry. The focus in the literature has not solely been on case studies, but there were efforts to use systems thinking as an instructional tool to facilitate the process of digital transformation [16,17].

In a similar manner, Bagheri and Hjorth [18,19] used systems thinking to showcase that sustainable development is a never-ending process and not a final destination, while de Oliveira Musse et al. [20] used the methodology to support complex decision-making processes with multiple stakeholders in planning for sustainable development in Brazil. Finally, Williams et al. [21], through a comprehensive literature review, identified education as one of the most important drivers for sustainable development.

Hence, the success or failure of digital transformation and sustainable development hinges significantly on various factors, with the behavior of individuals within organizations and their skill sets playing a crucial role. Numerous studies have sought to explore the perspectives of both employees and managers concerning these processes. However, it remains imperative to continually gather the most recent updates and opinions, recognizing the potential for shifts in viewpoints, especially in light of external events that may impact these dynamics. Hence, it is essential to highlight the ongoing nature of this exploration, underscoring the need for up-to-date insights into the evolving landscape of digital transformation and sustainable development within organizational contexts.

The definitions of digital transformation and sustainable development often lack precision, emphasizing the need for a shared understanding or representation of how these concepts might materialize within organizational contexts and impact their processes. This representation need not be exhaustive but should serve as a catalyst for dialogue and establish a common language accessible to all involved parties. Causal Loop Diagrams (CLDs) and systems thinking represent ideal tools for this purpose for several reasons. Firstly, they enable the depiction of an organization's system from a top-down perspective. Additionally, a diagram can serve both as the starting point and the culmination of this process, functioning as a powerful communication tool. Moreover, these diagrams possess the flexibility to be expanded and transformed into quantitative models, offering a more nuanced understanding of complex interactions. Lastly, their simplicity belies their ability to depict causal relationships, exposing hidden dynamics within the system.

Thus, the purpose of the current paper is twofold: to investigate what are the perceptions of organizations with regards to digital transformation and sustainable development and especially with regards to skills and education, and, secondly, to use the insights from these perceptions as a starting point for the use of systems thinking as a tool that could assist in achieving these two states.

The rest of the paper is organized as follows: Section 2 is focused on explaining the methodologies that were used to achieve the paper's objectives, while results are explained in Section 3. Conclusions and future research efforts are discussed in the last section of the paper.

2. Materials and Methods

To achieve the objective of the paper, a multi-pronged research effort was conducted. This effort was in the context of the SYSTEMA project (E+ KA2, 2020-1-IT02-KA204-080082), whose purpose was to increase the skills of employees in organizations by teaching systems thinking with a focus on how these skills could be applied to digital transformation and sustainable development.

The research started with a literature review using scientific databases on how systems thinking has been applied to digital transformation and sustainable development. In addition, desktop research of educational and research programs was conducted in order to identify potential gaps in the market. Once this part was finalized, interviews with the project partners (European organizations from academia, the business sector, and associations) and market experts indicated the kind of questions that they would like to see answered with regards to digital transformation and sustainable development.

A survey was designed and disseminated across Europe for 4 months (in an online form) with questions on digital transformation and sustainable development [22]. The questionnaire was divided into three sections: the first focused on digital transformation, the second on sustainable development, while the last attempted to capture the perceptions of people on the interaction between the two.

Once the responses were gathered, a process for data cleaning was initiated. Entries that were left unanswered were replaced with the notation N/A. Moreover, data entries with more than 50% of the questions not answered were completely removed from the database. The final database included 285 responses, which were analyzed with Excel.

The responses originated from 16 countries across Europe and the world, while the majority was in the 25–34 age cohort. Moreover, there were more answers from males than females. Finally, the respondents worked across a variety of sectors, including construction, engineering, information and communication, and education (Figure 1). It is essential to note that no sample calculation was executed as part of this project. The primary goal was to construct a dynamic and comprehensive understanding of organizations' perceptions regarding various aspects of digital transformation and sustainable development. This research, being a component of an EU-funded initiative governed by stringent timelines, faced constraints in terms of the population size due to the necessity of acquiring responses from a diverse array of backgrounds. Consequently, assumptions about the population size cannot be made, and it is crucial to underscore that the sample size is considered small. The emphasis on diversity within the respondent pool aimed to capture a broad spectrum of perspectives despite the logistical constraints imposed by the project's timeline and funding parameters. Finally, the results that are illustrated in the current paper are part of the overall research and more details can be found in [22].

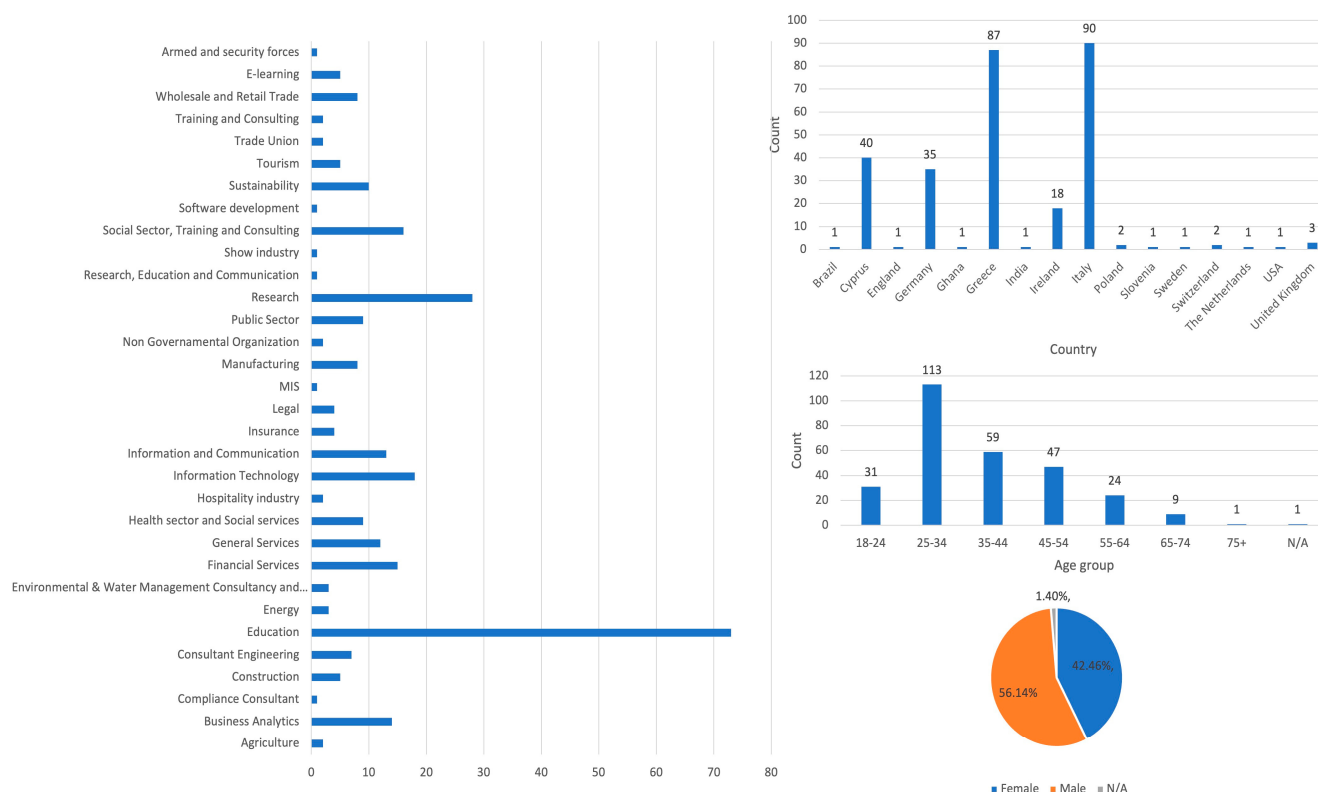


Figure 1. Demographics (the numbers along the x axis of the figure on the left represent the number of responses) [22].

After the analysis of the results and in accordance with a review of the literature, a general causal loop diagram was designed illustrating the processes of digital transforma-

tion and sustainable development within organizations from a top-down view. The whole research process is depicted in Figure 2 below.

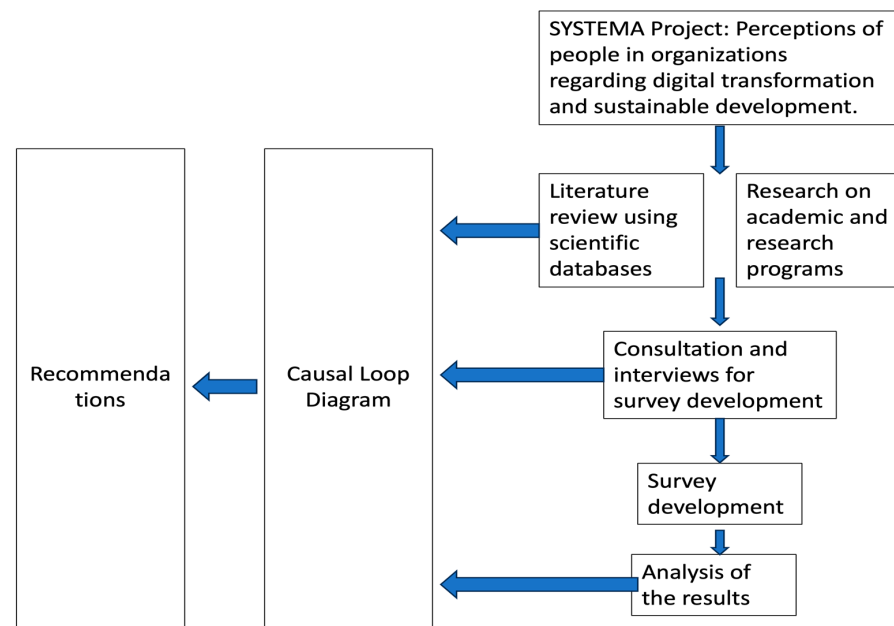


Figure 2. Flowchart of the research process.

Insights and results are discussed in detail in the following section.

3. Results and Discussion

3.1. Results on Digital Transformation

In the question whether the respondent believes that digital transformation can offer opportunities and competitive advantages, the vast majority either agreed or strongly agreed and only around 8% of the answers indicated that digital transformation is neutral to the organization (Figure 3). Thus, people agree with the general conclusions from the literature on the merits of digital transformation.

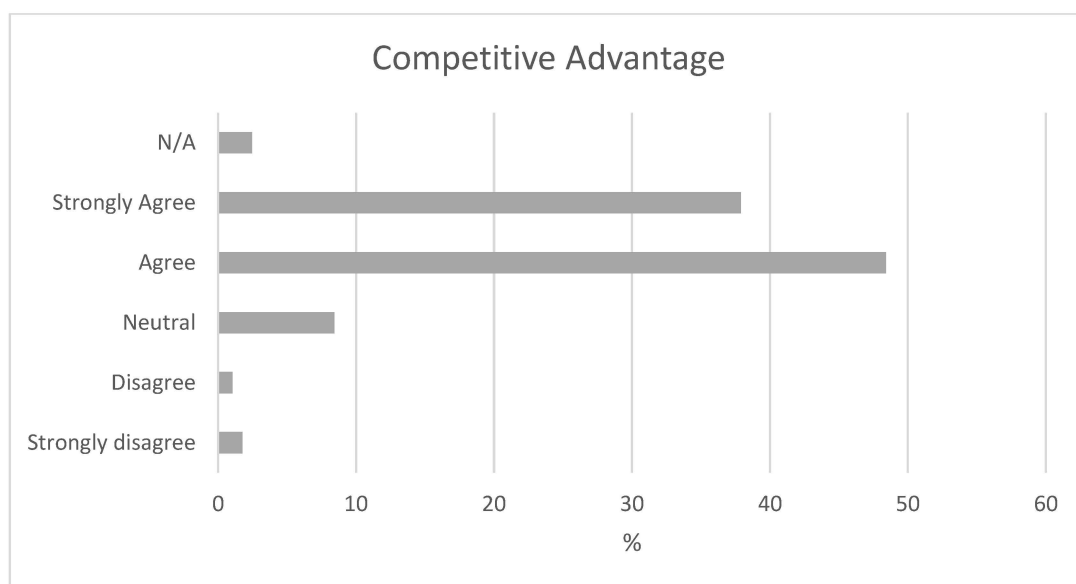


Figure 3. Opinions on whether digital transformation can offer a competitive advantage to the organization [22].

In addition, it was investigated whether there is a relation between the sector or role that a respondent has in the organization and whether digital transformation is seen as a competitive advantage. For that reason two chi-squared tests [23] were performed. The null hypotheses are stated as follows:

H0_1: *The perception that digital transformation can offer a competitive advantage to their organization is independent of their sector.*

H0_2: *The perception that digital transformation can offer a competitive advantage to their organization is independent of their role in the same organization.*

The results of the tests are summarized in Table 1 and show that both null hypotheses cannot be rejected. As a result, all types of employees, employers, teachers, etc., in all sectors recognize that digital transformation could be beneficial for their organization.

Table 1. Results of the chi-squared tests. H0_1: The perception that DT can offer a competitive advantage to their organization is independent of their sector. H0_2: The perception that DT can offer a competitive advantage to their organization is independent of their role in the same organization.

	χ^2	Degrees of Freedom	Critical Value for 5%	<i>p</i> Value
H0_1	193.22	198	231.8	0.58
H0_2	45.88	35	49.802	0.1

Moreover, a series of questions was asked about the status of Digital Transformation within each respondent's organization and more particularly:

1. If they believe that their organization has encountered difficulties in finding people with the appropriate skills;
2. If they believe that they are suitably prepared;
3. If their organization has started its digital transformation.

The results are illustrated in Figure 4 below.

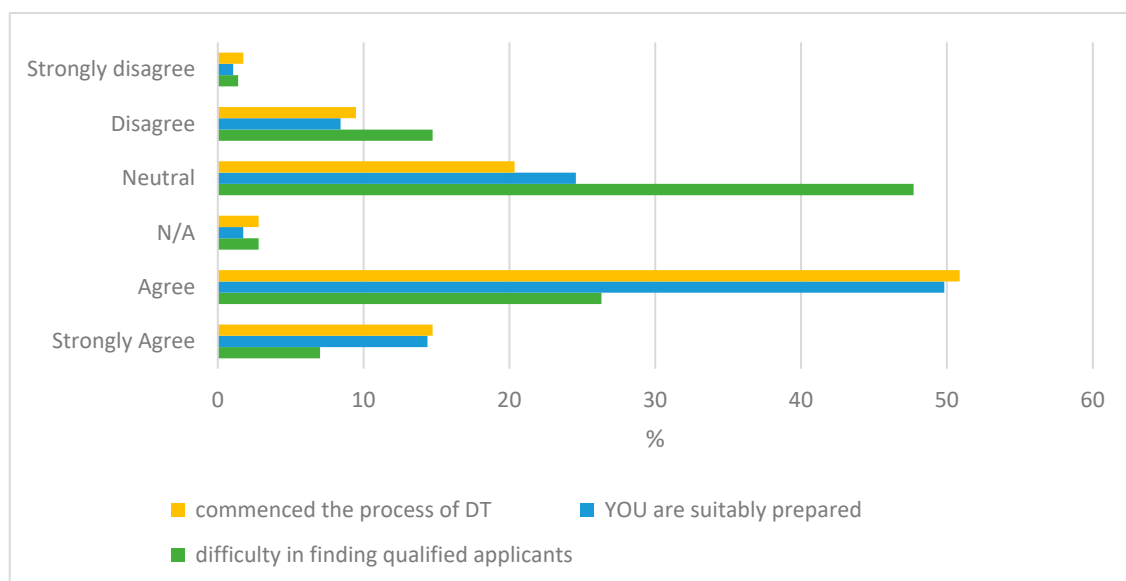


Figure 4. Answers on the process of digital transformation [22].

Notably, a significant portion of the responses regarding the challenges in locating suitable individuals was categorized as "Neutral". However, it is worth acknowledging that a notable proportion of respondents chose the "Agree" option, indicating some level

of difficulty. Simultaneously, the majority of respondents expressed confidence in their organization's initiation of the digital transformation process and their readiness for it.

In order to explore the potential relationship between the difficulty in finding appropriate individuals and the organization's progress in digital transformation, a chi-squared test was conducted. The null hypothesis is defined as follows:

H0: *The difficulty of finding suitable applicants within the organization is independent of the progress of digital transformation in the same organization.*

The summarized results are presented in Table 2 below.

Table 2. Results of the chi-square test. H0: The difficulty of finding suitable applicants within the organization is independent of the progress of digital transformation in the same organization.

	χ^2	Degrees of Freedom	Critical Value for 5%	<i>p</i> Value
H0	244.92	36	50.998	6.67242×10^{-33}

As evident from the results, the calculated value exceeds the critical value, leading to the rejection of the null hypothesis. Consequently, it becomes apparent that a relationship exists between the two inquiries, and this outcome is in line with expectations. When an organization struggles to identify suitable individuals, it is evident that the digital transformation process is likely to encounter significant challenges.

Finally, to assess the current skills gap, a question about which competencies are missing was asked and the respondents were given the following options (the list of competencies was designed after interviews with the project partners, attempting to capture a variety of upper level competencies that could be delineated to specific skills) and are presented on Table 3 below:

Table 3. Skills and their explanations.

Skill	Explanation
Literacy Competency	The ability to identify, express, understand, create, and interpret concepts, facts, and opinions; it implies the ability to communicate and connect effectively with others
Multilingual Competency	The ability to use different languages appropriately and effectively
Critical Thinking and Problem Solving Competencies	The ability to develop and apply critical thinking and insight in order to solve a range of problems in everyday situations
Competencies in Science, Technology, and Engineering	Competency in science refers to the ability and willingness to explain the natural world. Competencies in technology and engineering are the application of knowledge of science in response to human wants and needs.
Digital Competency	It involves the confident, critical, and responsible use of and engagement with digital technologies for learning at work and participation in society.
Personal, Social, and Learning to Learn competencies	The ability to reflect upon oneself, effectively manage time and information, work with others in a constructive way, remain resilient, and manage one's own learning and career
Citizenship Competency	The ability to act as responsible citizen and to fully participate in civic and social life based on an understanding of social, economic, legal, and political concepts and structures
Entrepreneurship Competency	The capacity to act upon opportunities and ideas and transform them into value
Cultural Awareness and Expression Competency	The ability to understand and respect how ideas and meaning are creatively expressed and communicated in different cultures
Business Management Competency	The ability to manage successful people and projects

The results are outlined in Figure 5 below. Notably, Digital Competencies, Competencies in Science, Technology, and Engineering, along with Learning to Learn Competencies, emerge as the most conspicuous areas lacking within organizations to facilitate successful digital transformation.

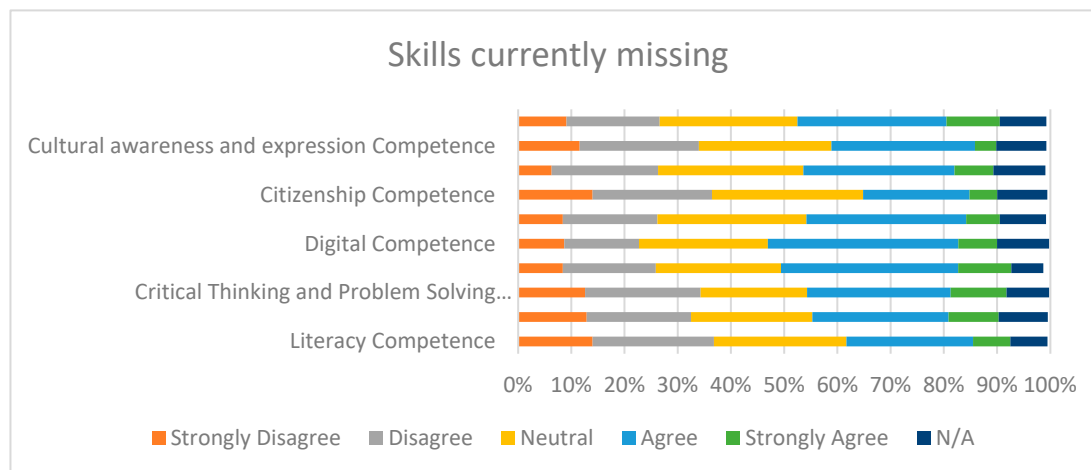


Figure 5. Results on missing skills for successful digital transformation [22].

In conclusion, several key lessons have emerged from the responses related to the issue of digital transformation within organizations. These lessons can be summarized as follows:

A significant majority of respondents either agree or strongly agree with the idea that digital transformation can provide a competitive advantage to their organizations. This reflects a widespread recognition of the potential benefits of embracing digital transformation.

Across various sectors and roles, including employees, employers, and educators, there is a shared understanding that digital transformation can be advantageous for their respective organizations. This consensus underscores the broad acknowledgment of the positive impact digital transformation can have.

The majority of respondents believe that their organizations have already initiated the process of digital transformation and concurrently feel adequately prepared for it. This points to a prevailing sense of readiness and commitment to this transformative journey.

It is noteworthy that the difficulty in finding suitable applicants for an organization is closely tied to whether the digital transformation (DT) process has commenced. This interdependency suggests that organizations struggling to locate the right talent may face significant challenges when embarking on their digital transformation journey.

Digital Competencies, Competencies in Science, Technology, and Engineering, as well as Learning to Learn Competencies, stand out as the most prominent areas lacking within organizations when aiming for successful digital transformation. These competencies are crucial components that need development and enhancement to support the successful execution of digital transformation initiatives.

3.2. Results on Sustainable Development

When examining the potential for sustainable development to provide a competitive edge to organizations, the majority of respondents express agreement, with 48% agreeing and an additional 31% strongly agreeing with this notion. This significant consensus highlights a prevailing belief in the capacity of sustainable development to confer a competitive advantage (Figure 6).

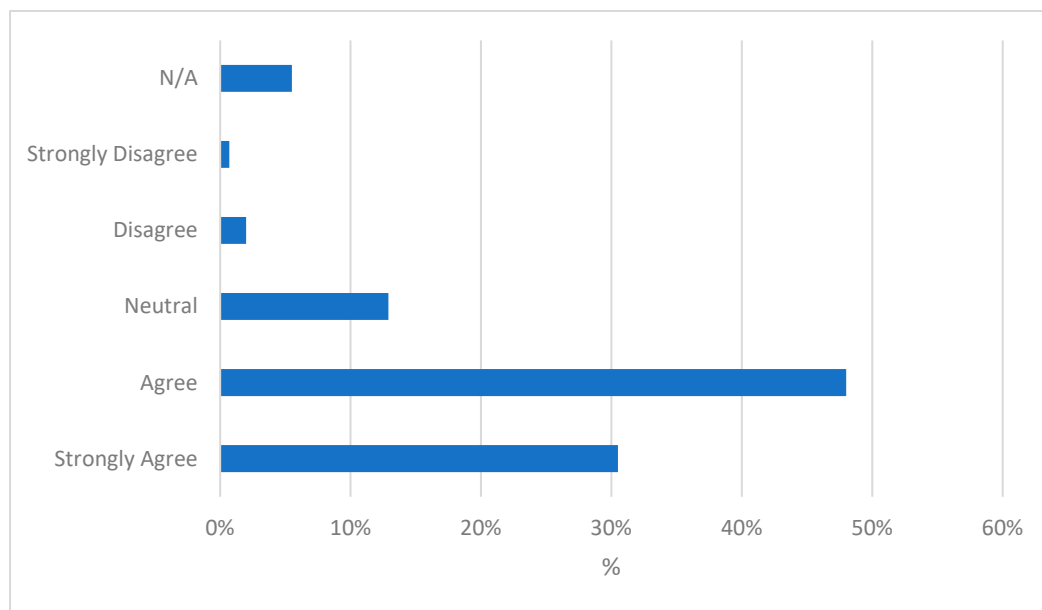


Figure 6. Opinions on whether sustainable development can offer a competitive advantage to the organization [22].

Furthermore, an analysis was carried out to determine whether there exists a correlation between a respondent's sector or role within an organization and their perception of sustainable development as a competitive advantage. The null hypotheses are as follows:

H0_1: *The perception that sustainable development can provide a competitive advantage to their organization is not influenced by their sector.*

H0_2: *The perception that sustainable development can provide a competitive advantage to their organization is not influenced by their role within the same organization.*

The results of the tests are summarized in Table 4, and they indicate that neither null hypothesis can be rejected. Consequently, it is evident that individuals across various sectors and roles, including employees, employers, and teachers, all share the perspective that sustainable development holds potential benefits for their organizations.

Table 4. Results of the chi-squared tests. H0_1: The perception that sustainable development can provide a competitive advantage to their organization is not influenced by their sector. H0_2: The perception that sustainable development can provide a competitive advantage to their organization is not influenced by their role within the same organization.

	χ^2	Degrees of Freedom	Critical Value for 5%	<i>p</i> Value
H0_1	153.82	198	231.82	0.99
H0_2	35.95	35	45.88	0.42

Moreover, a series of questions was asked about the status of Sustainable Development within each respondent's organization and more particularly:

1. If they believe that their organization has encountered difficulties in finding people with the appropriate skills;
2. If they believe that they are suitably prepared;
3. If their organization has started its digital transformation.

Figure 7 summarizes the results.

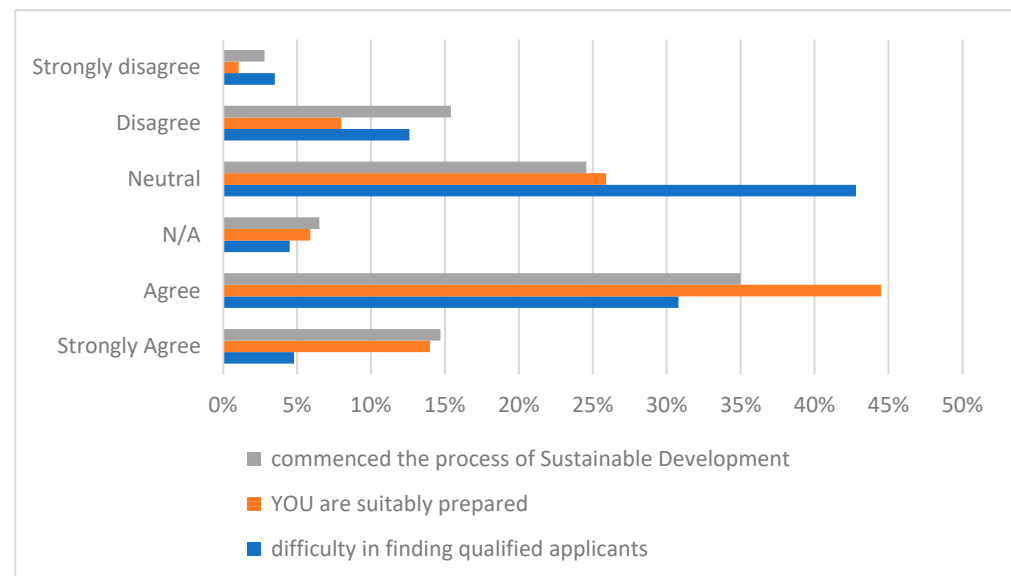


Figure 7. Answers on the process of sustainable development [22].

Notably, a significant portion of responses concerning the challenges in finding appropriate individuals leaned towards a “Neutral” stance. However, it is worth acknowledging the presence of difficulty, as the second-largest percentage of respondents expressed an “Agree” perspective. Simultaneously, the majority of respondents believe that their organizations have embarked on the sustainable development process and are adequately prepared for it.

In order to explore the potential relationship between the difficulty in finding suitable individuals and the initiation of sustainable development within organizations, a chi-squared test was conducted. The null hypothesis is articulated as follows:

H0: *The perception that the organization’s struggles in finding appropriate applicants is unrelated to the organization’s progress in commencing sustainable development.*

The summarized results can be found in Table 5 below.

Table 5. Results of the chi-squared tests. H0: The perception that the organization’s struggles in finding appropriate applicants is unrelated to the organization’s progress in commencing sustainable development.

	χ^2	Degrees of Freedom	Critical Value for 5%	p Value
H0	389.42	36	50.998	6.9977×10^{-61}

As evident from the data, the calculated value surpasses the critical value, signifying the rejection of the null hypothesis. Consequently, it becomes apparent that a relationship exists between the two variables, a result that aligns with expectations. When an organization encounters challenges in locating suitable individuals, it is evident that the initiation of sustainable development may encounter substantial obstacles.

Finally, concerning the skills that are perceived as lacking (Agree or Strongly Agree) within organizations to attain successful sustainable development, the most prominently identified areas include Business Management, Cultural Awareness, Entrepreneurship, Learning to Learn, Digital Competencies, and Competencies in Science. These competencies are viewed as being notably absent and essential for the achievement of sustainable development goals within organizations.

In summary, several valuable lessons have been gleaned from the responses concerning sustainable development within organizations. These lessons can be distilled as follows:

A significant majority of respondents either agreed or strongly agreed with the notion that sustainable development can confer a competitive advantage to their organizations, reflecting a widespread belief in its potential benefits.

Across various roles and sectors, including employees and employers, there is a unanimous acknowledgment that sustainable development can be advantageous for their respective organizations, underscoring a common understanding of its positive impact. The majority of respondents express a belief that their organizations have initiated the process of sustainable development and concurrently feel adequately prepared for this journey, emphasizing a strong sense of readiness and commitment.

Notably, the difficulty in finding suitable applicants for an organization is closely tied to whether the sustainable development process has commenced. This interdependency suggests that organizations struggling to locate the right talent may face significant challenges when embarking on their sustainable development endeavors.

Business Management, Cultural Awareness, Entrepreneurship, Learning to Learn, Digital Competencies, and Competencies in Science emerge as the competencies most conspicuously missing (Agree or Strongly Agree) within organizations, highlighting areas requiring attention and development to support successful sustainable development efforts.

Subsequently, the questionnaire allowed for an exploration of potential linkages between digital transformation and sustainable development. This involved scrutinizing whether responses to one issue were correlated with or influenced responses to the other. To accomplish this, a battery of statistical tests was conducted.

The primary null hypothesis inquires into whether the concepts of a competitive advantage in the context of digital transformation and sustainable development are interrelated, and it is articulated as follows:

H0_1: *The perception that digital transformation offers a competitive advantage to the organization is unrelated to the similar perception concerning sustainable development.*

Another pivotal question under examination involves the potential connection between the skills considered lacking for digital transformation and those lacking for sustainable development. The corresponding null hypothesis is expressed as follows:

H0_2: *The perception the organization has faced difficulties in finding suitable individuals for achieving digital transformation is unrelated to the similar perception regarding sustainable development.*

Moreover, a further investigation delved into whether responses to the question concerning the initiation of processes for digital transformation and sustainable development were interconnected. The null hypothesis guiding this analysis is framed as follows:

H0_3: *Whether the organization has initiated the process of digital transformation is unrelated to whether it has initiated the process of sustainable development.*

The responses are summarized in Table 6 below.

Table 6. Results of the chi-squared tests for H0_1, H0_2, and H0_3.

	χ^2	Degrees of Freedom	Critical Value for 5%	p Value
H0_1	102.58	36	50.998	2.58959×10^{-8}
H0_2	114.81	36	50.998	3.69478×10^{-10}
H0_3	91.77	36	50.998	9.15089×10^{-7}

The χ^2 result for H0_1 surpasses the critical value, leading to the rejection of the null hypothesis. Consequently, it becomes apparent that a relationship exists between digital transformation and sustainable development. Those respondents who view digital transformation as beneficial for an organization are more inclined to regard sustainable development as similarly advantageous.

The χ^2 result for H0_2 exceeds the critical value, necessitating the rejection of the null hypothesis. Consequently, respondents who acknowledge difficulties in finding suitable individuals for digital transformation are more inclined to report facing similar challenges in the context of sustainable development. This overlap in the skills required for both domains suggests that training individuals could potentially confer a dual advantage to any organization.

The χ^2 result for H0_3 surpasses the critical value, leading to the rejection of the null hypothesis. Consequently, the results suggest that respondents who affirm their organization's initiation of the digital transformation process are more inclined to respond similarly regarding sustainable development.

In summary, the battery of tests conducted underscores the numerous commonalities between digital transformation and sustainable development within organizations. Individuals perceive both processes as advantageous, they both exhibit a shared deficiency in specific skill sets, and an organization's commencement of the digital transformation journey often aligns with activities fostering sustainable development.

3.3. Systems Thinking for Digital Transformation and Sustainable Development

The authors of [20] developed causal loop diagrams (CLD) to depict in a systemic way the findings from the literature, a review of several educational and research programs on digital transformation and sustainable development, and the answers from a comprehensive survey. These diagrams were simple illustrations of how the two processes could affect the sustainability and growth of an organization and at which points the improvement of employees' and employers' skills could hinder or facilitate the two processes.

Nonetheless, the CLDs in [20] are generic and do not delineate clearly how digital transformation (with its effect on the quality of the product or service that the organization is producing) is causally connected with the dimensions of sustainable development. For that reason, a new CLD was developed in the context of the current paper that more clearly illustrates the relationships among these elements.

Central assumptions for the development of the CLD are the following:

- Sustainable development consists of three dimensions—an environmental dimension (represented as savings in resources), an economic dimension (represented as the revenues and costs of the organization), and a social dimension (represented as the effect it could have on the lives and development of employees).
- Digital transformation and sustainable development have effects on the quality of the product or service that the organization is producing. Their relationship is such that any increase (decrease) in one of the two processes will increase (decrease) the quality.
- Skills can directly affect the process of digital transformation (if one increases so does the other) and indirectly the process of sustainable development.
- Digital transformation depends on the necessary infrastructure. This representation encapsulates all the changes in mindset AND infrastructure that are necessary so that the organization proceeds in a meaningful digital transformation and not merely digitization.
- Finally, all the necessary aspects that affect digital transformation and sustainable development have a cost.

As it was mentioned above, the new CLD is not a comprehensive diagram. It enriches the diagrams of [20] and it is meant to communicate how the most basic relationships among various elements could affect both digital transformation and sustainable development.

Figure 8, below, presents this diagram. It showcases the fundamental components of the system interconnected by arrows denoting their causal relationships. These relationships can take one of two forms:

1. Positive—indicating that the variables change in the same direction, meaning if one increases, the other also increases, and if one decreases, the other decreases.
2. Negative—signifying that the variables change in opposite directions, implying that if one increases, the other decreases, and vice versa.

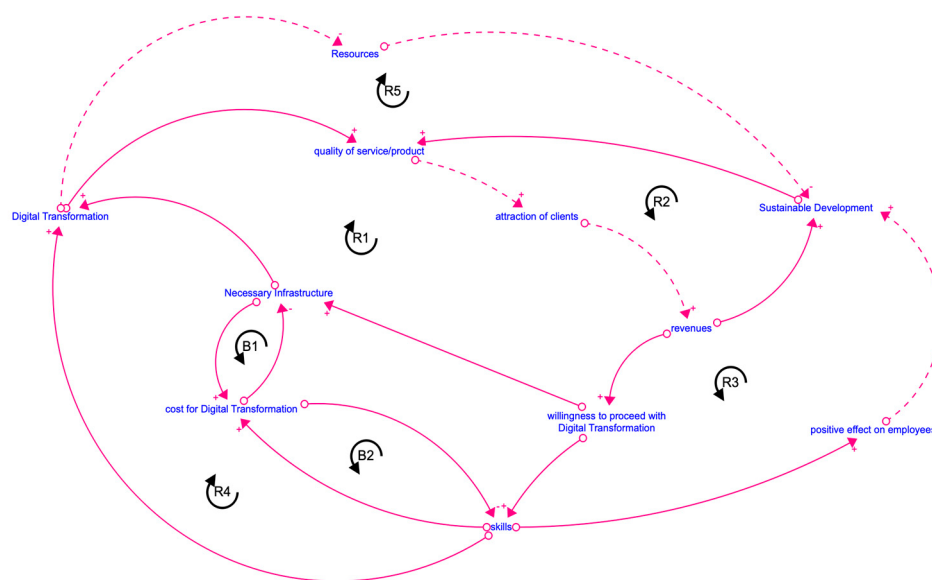


Figure 8. Causal loop diagram for the processes of digital transformation and sustainable development in an organization.

Additionally, the diagram features dotted arrows, which signify that the causal relationship between the connected elements includes a time delay. Furthermore, the connections within the diagram give rise to cycles or feedback loops, categorized into two types:

1. Positive loops (reinforcing loops)—these loops depict a scenario where an initial increase or decrease leads to a reinforcing increase or decrease after all the variables within the loop have been influenced. These are noted with the letter “R” in the CLD.
2. Negative loops (balancing loops)—in contrast, negative loops reveal that an initial increase or decrease in a variable leads to a decrease or increase after all the variables within the loop have been affected, sometimes even canceling out the initial change. These are marked with the letter “B” in the CLD.

As it can be observed, there are two negative feedback loops (B1 and B2) and 5 positive feedback loops (R1–R5).

The negative feedback loops establish connections between essential infrastructure, skills, and the cost incurred by the organization. As the required infrastructure for digital transformation expands, so does the associated cost of its development. However, an escalated cost implies a reduction in the development of additional infrastructure. A similar rationale applies to the enhancement of the skills possessed by the organization’s personnel. Consequently, even at first glance, it becomes apparent that cost serves as a pivotal driving force and a balancing factor for both digital transformation and sustainable development.

On the other hand, the positive feedback loops serve to bolster both digital transformation and sustainable development. For instance, loop R1 originates from the premise that an increased emphasis on digital transformation enhances the quality of the products or services offered by the organization. This heightened quality, after a delay, attracts a larger client base, resulting in augmented revenues, again with a temporal lag. The

increased revenues, in turn, act as a driving force for organizational management to continue with digital transformation efforts. This motivation, in a ripple effect, leads to the expansion of necessary infrastructure and ultimately culminates in improved levels of digital transformation.

Similarly, positive feedback loop R2 commences with the assertion that higher levels of sustainable development translate into an elevated quality of the services or products the organization provides. Following delays, the enhanced quality leads to the attraction of more clients and increased revenues, contributing to even higher levels of sustainable development.

It is crucial to note two key points. Firstly, the nature of positive loops implies that they reinforce a variable when it changes in the desired direction. However, the situation can swiftly turn negative if, for example, the level of digital transformation diminishes, resulting in lower quality, reduced client numbers, decreased revenues, and, ultimately, a decline in digital transformation levels.

Secondly, it can be observed that the positive effects of digital transformation and sustainable development may manifest at a later stage, while the costs associated with their implementation are nearly immediate. Striking a balance in this regard poses a formidable challenge for organizational decision-makers, as they must make choices that yield positive long-term impacts without jeopardizing the organization's short-term viability.

Finally, it should be noted that the CLD is an initial attempt to capture two complex processes. Hence, it is limited and may not capture the full scope or the elements that are necessary to better understand how to better achieve desired levels of digital transformation and sustainable development. Nonetheless, even in this simple representation, important insights are highlighted that could driver further processes.

One notable finding from our investigation is the close correlation between an organization's struggle to find suitable applicants and the initiation of the digital transformation (DT) process. This symbiotic relationship implies that organizations grappling with talent acquisition challenges may encounter significant hurdles when embarking on their digital transformation journey.

We also identified specific competencies pivotal for a successful digital transformation, with Digital Competencies, Competencies in Science, Technology, and Engineering, as well as Learning to Learn Competencies, emerging as the most prominent areas lacking within organizations. These competencies are indispensable components that necessitate development and enhancement to facilitate the seamless execution of digital transformation initiatives.

Furthermore, our research unveiled an apparent relationship between challenges in locating suitable individuals and the initiation of sustainable development. This underscores the substantial obstacles organizations may face when embarking on their sustainable development endeavors, especially in light of the identified skill deficits.

Our findings extend to the realm of sustainable development, where we identified skills perceived as lacking within organizations. Notably, areas such as Business Management, Cultural Awareness, Entrepreneurship, Learning to Learn, Digital Competencies, and Competencies in Science were highlighted as notably absent yet essential for the achievement of sustainable development objectives within organizations.

4. Conclusions

In this study, our primary objective was to delve into the perceptions of organizations regarding the interplay of digital transformation and sustainable development, particularly concerning skills and education. Furthermore, we aimed to employ systems thinking as a valuable tool to facilitate the realization of these two intertwined states.

The battery of tests we conducted reveals numerous commonalities between digital transformation and sustainable development within organizations. This alignment is manifested in the recognition of both processes as advantageous, shared deficiencies in specific

skill sets, and a synergistic relationship between the initiation of digital transformation and activities fostering sustainable development.

Additionally, our study underscores the temporal aspects of these processes. Positive effects of digital transformation and sustainable development may materialize at a later stage, while the costs associated with their implementation typically demand immediate attention. Achieving a balance between long-term benefits and short-term organizational viability poses a formidable challenge for decision-makers.

The contributions of the research are as follows: This research paints a detailed portrait of how organizations perceive the intersections of digital transformation and sustainable development. A key emphasis lies in the identification of missing skills within the workforce and management, accompanied by an exploration into potential educational avenues to address these gaps. Spanning across diverse sectors, the study encompasses a broad spectrum of organizational landscapes. A notable feature is the inclusion of a causal loop diagram that elucidates the intricate interplay and causal relationships among various elements within an organization. This visual representation serves to illuminate the factors that either impede or facilitate the trajectories of digital transformation and sustainable development, offering a holistic understanding of the dynamics at play within organizational contexts.

Several key recommendations can be formulated for organizations navigating the intersection of talent acquisition, digital transformation, and sustainable development.

Recognizing the identified competencies crucial for successful Digital Transformation—Digital Competencies and Competencies in Science, Technology, Engineering, and Learning to Learn—it is imperative for organizations to institute comprehensive skill development programs. These initiatives should focus on enhancing these competencies among employees to ensure they are well-equipped for the evolving demands of the digital era.

Acknowledging the symbiotic relationship between talent acquisition struggles and the initiation of DT processes, organizations should develop integrated strategies that align talent acquisition efforts with the digital transformation journey. This entails not only seeking individuals with the required competencies but also fostering an internal culture of continuous learning and adaptability.

Given the apparent relationship between challenges in locating suitable individuals and the initiation of sustainable development, organizations should prioritize focused initiatives to address skills deficits. This involves targeted programs in Business Management, Cultural Awareness, Entrepreneurship, Learning to Learn, Digital Competencies, and Competencies in Science. Such initiatives will contribute to building a workforce capable of driving sustainable practices within the organization.

Organizations should conduct regular assessments to identify the existing skill sets of their workforce and conduct gap analyses against the competencies crucial for both digital transformation and sustainable development. This ongoing evaluation will provide insights into areas requiring further development and refinement.

Given the complexity of the challenges posed by the positive and negative loops in the context of digital transformation, organizations should adopt systems thinking. This involves understanding the interconnectedness of variables and recognizing that changes in one area can have cascading effects. It is crucial for decision-makers to anticipate potential negative repercussions and take proactive measures to mitigate them.

Recognizing the temporal disparity between the manifestation of positive effects and the immediate costs associated with digital transformation and sustainable development, organizational decision-makers must adopt a strategic perspective. Striking a balance requires choices that yield positive long-term impacts without compromising the short-term viability of the organization. This necessitates a careful evaluation of the timing and sequencing of initiatives.

In essence, these recommendations advocate for a proactive and integrated approach to talent management, skill development, and organizational strategy. By aligning these

elements, organizations can better position themselves to navigate the challenges of the digital landscape and contribute meaningfully to sustainable development.

Lastly, it is essential to recognize that the causal loop diagram (CLD) presented in this study represents an initial attempt to capture two intricate processes. While it serves as a simplified representation, it may not encompass the entire scope of elements necessary for a comprehensive understanding of how to achieve desired levels of digital transformation and sustainable development. Nonetheless, this preliminary model highlights crucial insights that can propel further discussions and processes in these areas. All these gaps are avenues that we intend to explore in future efforts.

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