Ergonomics for sustainable development: issues, models and practices from the historical analysis of the ARPEGE's French commitee "Design for Sustainable Development"

Ergonomics for sustainable development: issues, models and practices

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ABSTRACT

This paper presents the French Committee "Designing for Sustainable Development" (CDSD) and aims to show how a group of researchers and practitioners in ergonomics and psycho-ergonomics has taken up the challenges of sustainable development and (an ethic of) scientific collaboration. The historical evolution of the works and activities of the CDSC is examined. This analysis highlights a range of models, fields of action, and objects of investigation that illustrates the diversity of issues and research or interventions led by the committee. A final section proposes perspectives for the committee at different levels: methodological, epistemological, semantic, conceptual, political, and linked to the training for ergonomists. We conclude with the importance of promoting both an anthropo-centered design of work systems, in a context where the general trend remains techno-centered and techno-solutionist, and, at the same time, overcoming it to develop alternative approaches vivo-centered. A strengthened dialogue between CDSD and other disciplines is an essential way for achieving this objective.

CCS CONCEPTS

• **Sustainability**; • **Socio-technical systems**; • **Activity centered design**;

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KEYWORDS

Ergonomics and sustainable development, Methods, Models, ARPEGE French's committee, Historical analysis, Perspectives for research and interventions

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1 INTRODUCTION

In the late 1980s, the notion of sustainable development (SD) was introduced by the Brundtland Report of the United Nations World Committee on Environment and Development. In this document, SD is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" ([1], p.40). In 1994, the link between ergonomics and SD became visible at the IEA Congress in Toronto. Indeed, [1] points out the contribution that ergonomics could make to sustainability issues on a global scale (shortages of water, energy, food, etc.). Since then, the "Triple Bottom Line" (TBL) model [3], which aims to balance three pillars: environmental, economic, and social, has been adopted by ergonomists and others as a framework for SD. While environmental and economic concerns are the most frequently considered aspect of SD, the social aspect tends to be ignored.

Several models and proposals co-exist in ergonomics today, notably for thinking about the different scales of ergonomics intervention [4–6], more sustainable work systems [7–9], and the place

of the worker or user and their activity at the center of a system that transcends them [10–12]. However, the notion of SD does not today meet with any consensus in the scientific community [13, 14]. It has been the subject of intense debate regarding its definition, objectives, timeframe, and means of implementation (for a full review, see [14]). Moreover, there is relatively little contribution from Ergonomics and Human Factors (HFE) to sustainability issues [15, 16] despite the community's willingness to get actively involved "to solve HFE problems over space (i.e., geographical distribution) and time (i.e., intergenerational), by addressing multiple goals simultaneously (i.e., the TBL), while focusing on the design of work systems" ([17], p. 1513). In this dynamic, the Committee "Designing for Sustainable Development" (CDSD) of the Association for Research in Ergonomic Psychology and Ergonomics[1] (ARPEGE) was founded in 2015 in France. Its goal is to meet the wishes of some ergonomists and psycho-ergonomists to debate the challenges of SD and ecological transition by considering these issues from the point of view of human activity, with maximum openness to the diversity of conceptual and methodological frameworks used by ergonomists, in line with a sustainable scientific research ethic.

The CDSD includes ergonomists and psycho-ergonomists, who are increasingly called upon to rethink the meaning and forms of their practice by getting involved in projects that take SD into account, whether because of their expertise and their personal and professional ethics. Its network and approach, firmly targeted at local initiatives, make the CDSD a driving force behind initiatives in France on the links between ergonomics and SD, with no intention of running them or benefiting from them. The CDSD provides an open and regular forum for researchers and practitioners interested in developing their practice and research more explicitly toward these critical challenges. However, its purpose is not to gather all researchers and practitioners in ergonomics who are concerned with SD. To do that, the CDSD organizes 3 to 4 events per year with different formats: seminars, workshops, or symposiums at national and international conferences, webinars, etc.

The aim of this paper is to discuss the way how work in ergonomics and ergonomic psychology has addressed SD issues over time. To do this, we will focus on the CDSD, which brings together various researchers and practitioners interested in these issues. Furthermore, as part of the ECCE 2024 conference in France, the intention is to show how a group of French researchers in ergonomics and psycho-ergonomics has taken up the challenges of SD and participation, and adapted its proposals, so illustrating a constant evolution in the way it tackles these issues. This paper, therefore, first traces the history of the CDSD. Secondly, the committee's work is presented through the topics and issues discussed. From this synthesis and in the last part, this paper proposes to build new perspectives for the committee, at the same time methodological, epistemological, semantic or conceptual, political, and eventually related to the training of ergonomists. One of the challenges for the CCDD is to put forward a set of common theoretical and methodological approaches in order to make its voice heard within the scientific community. While this paper is limited to the work of the CDSD, its findings and perspectives should be discussed with a broader community of ergonomists involved in the issues that SD raises for the profession.

[1]Translated from the French "Association pour la Recherche en Psychologie Ergonomique et Ergonomie"

2 HISTORICAL ANALYSIS OF THE EVENTS HOSTED BY THE CDSD

The CDSD's events since 2016 have been summarized in Table 1. The following information is provided: date and type of event, associated keywords, and the concerned sector(s) of action.

3 EARLY YEARS OF THE CDSD (2015-2018): LAYING THE FOUNDATIONS

The CDSD was established in 2015 as a result of a meeting between two French researchers working on energy management projects. Soon after, other French ergonomics and psycho-ergonomics researchers and stakeholders showed an interest in participating in the exchanges. The committee was named "Designing for Sustainable Development" to exchange more explicitly and regularly on SD issues, whatever the field concerned, and the theoretical approach and methodology deployed. The first ten members of the CDSD initially met in January 2016 to define the themes to be addressed (initially energy, agriculture, and mobility) and set a framework for the committee. The first seminar in May 2016 provided an opportunity to reflect on the integration of the environment and the territory in product design, as well as the human dimensions of SD. Then, a symposium was organized at the Congress of the SELF (2016), aiming to present fresh perspectives on the evolution and contributions of ergonomics to SD. The CDSD was soon keen to bring in outsiders to expand on the themes and work of its members. The year 2017 began with a seminar on theoretical and methodological issues with Andrew Thatcher as guest speaker. This was followed by another seminar on studying activity over long periods and organizing a symposium at EPIQUE conference (2017) on the relationship between technology appropriation and the transformation of research practices related to SD in ergonomics. 2017 ended with a seminar on the issues of intervention devices and methods in ergonomics with François Hubault as a guest. 2018 began with a seminar on the fields, objects, and principles of research and intervention for SD. A seminar on new forms of work organization followed in July.

Thus, the significant contribution of the CDSD is to enable its members to regularly exchange views on the issues they encounter in practice by organizing at least three seminars yearly. The committee serves as an open forum for reflection, which is only sometimes possible within the usual institutional conditions. From the outset, the CDSD has aimed to encourage discussions on concerns and values that are only partially developed in day-to-day professional activity. The committee provides a debate space for researchers and practitioners to express their values in connection with their work, whether it is still in progress or already completed. This "ethical space" allows different values to coexist and complement each other, leading to a new working configuration for researchers. The CDSD is a space where experimentation is encouraged, and ideas need not be formalized to be discussed. Furthermore, it is not oriented towards a uniform theory not to exclude people with different approaches. These conditions represent the foundations of the committee and are still particularly important from our point

Table 1: Overview of the events hosted by the CDSD since its creation in 2015 (the terms 'communication' and 'workshop' are hereinafter referred to as 'comm' and 'WP').

Date	Type	Keywords	Sector
September 2024	Symposium at RIODD 2024 (5 comms)	Supporting (poly)transitions in organizations from the point of view of real work activity with a view to regeneration	work organization and sustainability
June 2024	Webinar (1 comm)	Socio-affective and cognitive aspects of coordination - Distributed work community - Work Psychology - Educational Psychology	Information & Technology
May 2024	WP	Comparison of systemic models used in ergonomics	No particular sector
April 2024	Webinar (1 comm)	Organizational change management - Managerial work Work transformation - Private catering - Management Science	Food & Agriculture
March 2024	Seminar in collaboration with the GAS (Gender, Activity, Health) Group (4 comms)	Gender - Decent work - Health - Territory scale - Gesture analysis - Space analysis - Anthropology	Construction industry Waste industry Agriculture
February 2024	Webinar (1 comm)	Teamwork - Self-governance - Psycho-social risks - Work psychology	Home care
January 2024	Webinar (1 comm)	Transition management - Organizational change - Work activities - Gardens and green areas	Public sector (collectivities)
December 2023	Seminar in collaboration with the cooperative "Coopilote" (3 comms + 2 WP)	Systemic approaches - Systemic analysis - *Entreprise à mission* - Sustainable System of System model - Cultural-Historical Activity Theory - Developmental approaches	Social and Solidarity Economy
October 2023	Special issue in the revue *Activités* (5 articles)	Article 1: Design support tool - Collaborative design - Change management Article 2: Instrumental genesis - Energy transition - Appropriation of technologies Article 3: Activity-centered design - Territory - Public action - Human-Machine interaction Article 4: Cooperation - Territory - Public policy - Keeping older people in employment Article 5: Occupational risks - prevention - Service relationship	Agriculture Sport Research & Higher education Public sector (collectivities) Energy
July 2023	Symposium at the 12th EPIQUE conference (4 comms)	Body dynamics and sustainability issues - Sensorial experience - Emotional experience - Methodology to analyze	Sport, Gender studies
May 2023	Seminar (1 comm + 2 WP)	Anthropocene - Work prospective - Public policy and society - Ethical positioning of ergonomics	Public sector, Fishery industry, Recycling industry
May 2022	Seminar (4 comms)	Online epistemic community - Collaboration - Shared services experience - Design principles - Energy Management Activities - Use of biodegradable products	Housing, Fishery industry Agriculture
October 2021	Seminar (5 comms)	Territory - Senior employment – Economy - Innovation - Sustainable food procurement - Low-Tech	Education, Food & Agriculture, Public sector
July 2021	Double symposium at the 11th EPIQUE conference (6 comms)	Multi-scales analysis - Temporalities - Organization – Organizational levels - Territory	Food & Agriculture, Energy, Waste industry
May 2021	ARPEGE seminar (1 comm)	Concept of transition - Evolution of activity - Instrumental approach	Agriculture
December 2020	Seminar (1 comm + 1 WP)	Social work - Solidarity at work - Collaborative design - Psycho-social risks	Social and Socially Responsible Economy
November 2020	Seminar (3 comms)	Multiple times and temporalities - Work organization - Longitudinal approaches - Qualitative and quantitative methods	Agriculture, Energy

January 2020	LE CNAM seminar (4 comms)	Ethics of ergonomics - Ergonomic intervention - Ergonomist role and positioning	Ergonomics
September 2019	Round Table at the 54th Congress of the SELF (6 comms)	Ethics of ergonomics - Training of ergonomists - Ergonomic intervention - Ergonomist role and positioning	Ergonomics
June 2019	Special issue in the revue *Psychologie Française* (5 articles)	Article 1: Design activity - Design support tool - Temporality Article 2: Modeling – environment – change in practice Article 3: Ergonomics principles - Methods and approaches – Lived experience – human-machine-environment interaction Article 4: Appropriation – experience, design Article 5: Occupational risks - prevention - Service relationship	Agriculture, Ergonomics Domestic activities, Energy
April 2019	ADEO seminar (1 comm)	Presentation of the work of the committee to ergonomists in training	Ergonomics
March 2019	Seminar (2 comms)	Eco-conception - Management of energy consumption	Energy, Building, Housing
November 2018	Seminar (2 comms)	Energic transition	Hydrogen energy
August 2018	Communication at the 20th Congress of the IEA	Sustainable Development and Ergonomics: A Reflection Stemming from the Commission "Concevoir pour le Développement Durable"	Ergonomics, Institutions
July 2018	Seminar (3 comms)	New forms of work organization	Social and Solidarity, Economy
March 2018	Seminar (2 comms)	Ergonomics intervention - Ergonomics principles - Methods and approaches	Ergonomics, Energy
December 2017	Seminar	Ergonomics intervention - Ergonomics principles - Methods and approaches	Service economy, Economy of functionality and cooperation, Energy
September 2017	Symposium at the 52st Congress of the SELF (1 comm)	Sustainable Development and Ergonomics: A Presentation of the Commission "Concevoir pour le Développement Durable"	Ergonomics, Institutions
July 2017	Symposium at the 9th EPIQUE conference (3 comms)	Appropriation of technologies - Social innovation - Smart Grid - Community of practice - Online Community	Energy, Agriculture
June 2017	Seminar (4 comms)	Temporalities - Longitudinal Approach - Design	Energy, Agriculture, Information technology
January 2017	Seminar (3 comms)	Ergonomics principles - Methods and approaches Sustainable systems-of-systems – Situated action/cognition	Agriculture, Fishery, Ergonomics, Energy
September 2016	Symposium at the 51st Congress of the SELF (5 comms)	History and future of ergonomics - Approaches and methods to analyze transitions - Corporate social responsibility - Lived experience	Ergonomics Engineering & management, Agriculture, Private sector (SME), Transport, Energy
May 2016	Seminar (1 comm)	Concept of sustainable development	
January 2016	WP	Definition of future themes and actions of the committee	No particular sector

of view. As SD is a field that is in the process of being institutionalized within the discipline, the work and research that takes it into account is often experimental in nature.

At the end of this period in the life of the CDSD, members discussed potential areas of focus for the future. A paper presented at the 20th IEA Congress in 2018 outlined key action points, such as structuring French ergonomics research more around SD issues, collaborating with regional or local ergonomist associations, and integrating SD knowledge into training programs. Initiatives have been taken in this direction with, for example, the organization in spring 2018 of a workshop for ergonomics masters (1st and 2nd year) around the possible relationships between ergonomics and SD. This workshop encouraged students to approach their placements from a different angle. The workshop was based on the "sustainable development prism" concept proposed by Magali Prost and Gaëtan Bourmaud (then coordinators of the CDSD) and reused by [18].

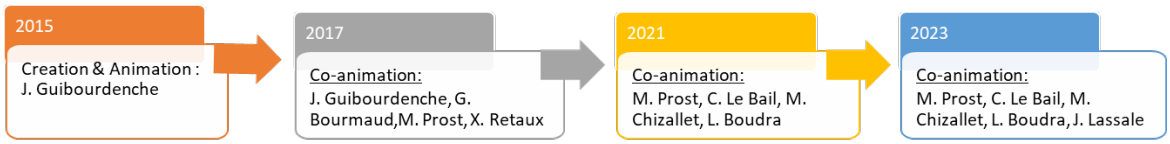

Figure 1: Animation of the CDSD from 2015 to today.

This concept emphasizes the importance of conducting ergonomic interventions by identifying criteria and values associated with the multidimensional socio-ecological model. Some participants have already started incorporating this concept into their work and are continuing to refine their interventions accordingly (e.g., [19]).

This first level of actions conducted by the CDSD partly meets ARPEGE's objectives, translating them into SD terms. These objectives include facilitating exchanges between researchers, encouraging recognition and dissemination of their work, promoting student training programs, improving research development conditions within institutions, enabling better multidisciplinary collaboration, promoting international scientific exchanges, establishing partnerships with various scientific and professional associations, promoting corporate research, and establishing a lasting relationship between research and business needs.

3.1 The development years of the CDSD (2018-2023): openness and diversification

The CDSD reached a turning point in 2017 with a change in its mode of governance: the decision was made to co-steer it. This modality of animation has continued to the present day (Figure 1) and includes five animators. Although the members of the animation team have changed in 2021, it is interesting to note that the CDSD has kept a "relay" person who was already present in 2017 and who is now continuing the animation, to ensure a certain continuity. The former animators have remained members of the committee, and act as resource persons for the animators. What's more, three and then four new members have taken on the role of animator, which may have led to a renewal of the themes addressed by the CDSD.

In terms of animation, new initiatives have been made. While the initial phase until 2018 favored internal seminars and symposiums at conferences, external seminars were organized in April 2019 and January 2020, and a seminar was co-organized with the GAS collective (Gender, Activity, Health). Additionally, a round table was organized in 2019 at the 54th Congress of the SELF. Gradually, workshops also found their place within the CDSD to promote the sharing of knowledge and practices. Furthermore, the CDSD has extended the reach of its work beyond oral communication formats by constructing two special issues published in 2019 in the journal "Psychologie Française" (in English and French) and then in the journal "Activités" (in French).

The CDSD has also changed the format of the seminars it proposes. Since 2023, 3 types of format have been offered: 1/ "classic" seminars with presentations of work in progress or finalized work, in a hybrid format (face-to-face and distance learning), 2/ a series of one-hour webinars in which doctoral students have the opportunity to speak, enabling a wide audience to be reached, 3/ "off-site" days where visits to professionals provide an opportunity to discuss concrete issues. This was the case, for example, with a visit to a fishing port in Lorient and a visit to an activity and employment cooperative (Coopilote) in 2023. During these visits, the CDSD members tested and improved the models, concepts, and approaches discussed in "classic" seminars and the professionals discovered how ergonomics can effectively tackle SD issues. Some CDSD members found that this experience opened up possibilities for developing participatory research. Moreover, the variety of these formats helps to maintain a high level of dynamism and regularly renews the members of the network.

A closer look at the evolution of the topics addressed by the CDSD reveals a diversity of themes over the years. From 2018 to 2020, these themes seem to focus in particular on ergonomic intervention, the social and environmental impact of work, and professional ethics. More broadly, the CDSD has covered a wide range of themes, including energy transition; technology; ergonomic principles, methods, ethics and training; new forms of work organization; eco-design and psycho-social risks. It also provided an opportunity to explore research work in various sectors of activity, with a particular focus on the energy sector, agriculture, and ergonomics. From 2021 onwards, the CDSD notably diversifies the sectors explored. Indeed, in addition to those already explored, sectors such as waste industry, fishing industry, public sector, housing, sports, gender studies, research and education, information technology, food, and building are primarily included. Finally, this analysis reveals a continuous broadening of the investigation areas of the CDSD over time, reflecting an adaptation and diversification of its research interests in response to social, economic, environmental, and organizational developments and challenges.

3.2 Since 2024: a collective with a positioning for the ergonomics community via a set of principles

The CDSD has always been keen to highlight the diversity of approaches used by ergonomists to address SD issues in their research and work. These debates show the complexity of these issues and the wealth of ergonomists' responses in constructive, cognitive, prospective approaches, etc. However, it seems necessary today to consider an evolution of the committee so that it becomes a more structuring support for the development of research in ergonomics. It would then involve moving from a framework that initiates discussions and raises questions to a collective that embodies a theoretical and methodological position based on a set of principles (both theoretical and methodological). In this sense, the CDSD's experiences highlight certain invariants in these interventions, which we think would be helpful to relay to the community.

3.2.1 Stabilized principles. This communication demonstrates that numerous thematic have been addressed during various events organized by the CDSD. Through exchanges among CDSD's members as well as external guests, presentations, and workshops, a number of concepts and methods have been tried and tested. Ultimately, different principles have been gradually co-constructed. Among these principles, several seem to be stabilized and have gained consensus within the CDSD. We identified three stabilized principles that underpins our research into SD.

Systemic, multi-level, and diachronic principles. The challenges of SD within organizations can only be fully addressed with an approach that integrates, on the one hand, human-activity-system relationships and, on the other, a better understanding of their socio-historical determinants. Indeed, intervening and designing for SD requires a systemic ergonomic analysis [11, 12, 20, 22]. Therefore, ergonomics' interest in SD issues is necessarily situated at different scales and various timeframes. Since its creation, the work discussed within the CDSD has emphasized systemic and multiscale approaches, integrating, for example, geographical variables, public policy actors, national and supranational regulatory frameworks, etc. [22–24]. The diachronicity of the determinants of human activities and their effects to be considered has also often been addressed, as well as the development of people through experience. SD implies multiple times: what is happening hic et nunc, what has happened in history, and what might happen in the future.

Today, the CDSD is committed to bringing together systemic approaches from different fields, such as the Sustainable System of Systems approach [6, 11] and the Cultural-historical activity theory [25]. Cross-referencing existing models aligns with our continuing strong interest in discussing with other disciplines and imagining possible conceptual articulations and methodological hybridizations to better respond to the complex issues of SD.

Multi-disciplinary principles. SD issues can only be solved by extending the scope to include multi-disciplinarity. Like most other disciplines, ergonomics has matured in these areas. We believe the future path must be based on a strengthened dialogue with disciplines specializing in the environment, the living world (geologists, geographers, biologists, etc.) and social sciences in particular. The challenge today is to build a multi-disciplinary research specific to SD issues, supported by dedicated bodies such as multi-disciplinary laboratories (currently lacking) and multidisciplinary scientific journals. This implies a reflection on the evaluation of this research (e.g. length of articles, etc.) and the careers of researchers. This also questions the ability of the CDSD, rooted in an association within the field of ergonomics, to open up and attract other disciplines into its fold for greater multi-disciplinarity.

Training objective principles. There is also a solid institutional challenge. In France (as elsewhere), companies and public institutions are under increasing pressure to commit to the ecological transition. For example, the French Ministry of Higher Education calls for training modules on ecological transition to be incorporated into university courses. This raises the question of whether a more explicit stance on the theoretical or methodological aspects of SD is necessary if the CDSD is to play a more significant part in the dialogue with other associations and institutions. It could then involve agreeing on a shared approach to training objectives based on the common principles already established and to be stabilized, and considering the implementation of these objectives in various ergonomics training programs. These are perspectives for our committee to help create collective resources for teaching ergonomics and ergonomic psychology for SD issues. We could go a step further and try to integrate SD knowledge with a multi-disciplinary approach into training programs. This would make it possible to overcome the constraints of traditional disciplinary formats, which are still the dominant rule in France. Integrating SD knowledge into training programs would also enable the creation of new training methods.

3.2.2 Emerging principles. The emerging principles mentioned in the following sections correspond to those held by researchers on the CDSD who wish to put them up for discussion within the community. These perspectives are structuring avenues for a future work program for the CDSD in the months and years to come.

Epistemological, methodological and ethical principles. A first set of emerging principles concerns those of an epistemological and ethical nature. We believe that the CDSD's network would be an ideal place to experiment with participatory approaches that strengthen the link between society and research and are aligned with societal needs. This requires reflection on the role of the individuals with whom the research and interventions are conducted (from observed subject to co-actor in the research process) and of ergonomists (from researcher or intervener to co-actor in the research process). In line with the transformations promoted by constructive ergonomics (i.e. transformations of work, organizations and individuals to develop their power to act), which federates the CDSD's network, and by the proponents of disruptive socio-economic models, one question could be to move from "extractivist" research (gathering data to produce knowledge) to 'radical' participatory research [as a distancing operation from the accepted norm, see [26]).

These methodological and ethical challenges necessitate highlighting the experience the CDSD members have built up over the years, enabling them to support collectives in better integrating SD issues into their activities, for example, the recent events organized in 2023 with a visit to the fishing port and discussions with the cooperative of activities and employment. It also invites us to think about new ways of valorizing co-produced knowledge, such as plural writing (professional researchers, trade experts, research co-actors, etc.) or writing in the name of a collective (i.e., without ranking first-name authors). This involves identifying the scientific journals likely to accept these contributions and ensuring that they are considered in the evaluation processes of institutional researchers.

The CDSD also offers an opportunity to develop debate spaces to collectively (re)think about the ergonomist's posture, whether in research or during interventions. The goal of contributing to the commons could be a strong principle that better integrates the crucial, universal and urgent objectives of preserving and regenerating natural ecosystems. Integrating ecology, and more broadly SD, as an essential dimension of activity could be a new challenge for the CDSD. These discussion spaces could also encourage reflections on the notion of "radicality" within the epistemological and

methodological movements of ergonomics from the point of view of integrating participatory objectives and the preservation and regeneration of the living (which encompasses occupational health issues). Additionally, these spaces could provide an opportunity to discuss the evolution of a professional ethic situated in a space, a temporality, and a cluster of socio-ecological problems.

Political principles. The political dimension of ergonomics, i.e. policies and regulations at international, European, national or territorial level and political as work, are issues discussed by the CDSD [21, 24, 27]. As a discipline of intervention, and considering socio-ecological emergencies, a dialogue could be opened on the role of ergonomics regarding the integration of the regenerative perspective of "Living Beings" [28] and the development of increasingly participatory methods for intervention and research. This would involve creating a space for dialogue and collaboration oriented explicitly toward a better understanding of both political activities and political systems. The aim would be to create a more effective alignment between working conditions and regulatory design, focusing on achieving SD and ecosystem regeneration objectives.

4 DISCUSSION

Through the lens of SD, ergonomics aims to contribute to a sustainable and participatory future. This historical analysis of the activities of the CDSD shows a range of models, fields of action, and objects of investigation. In this way, this paper illustrates the diversity of issues and research or interventions led by CDSD members and special guests. This also confirms the diversity of local contexts and demands. Some address macro issues (i.e., changes in public policy); in contrast, others focus on micro issues (i.e., activity and uses transformations), and others on meso scales (e.g., transitions in food systems, value chains, or waste management systems). It reveals the various ways in which ergonomics research on SD is undertaken, and the variety of projects in which ergonomists are involved.

Supporting and achieving sustainable transitions led us to start by looking in depth at the social dimension of SD. Doubtless, this was the area where we felt we had the most significant legitimacy to contribute to SD in a context where this aspect appeared to be little considered in the TBL. Our methodological tools have contributed significantly to this goal by mobilizing approaches that focus on activities and uses and by using participation, reflexivity, and simulation tools for change. They provided concrete responses to the renewed needs of workers, users, collectives, and citizens to be more involved in defining and designing their living and working environments. Such experiences make it clear that we share one of the central themes of this conference: "Proper participatory processes are a key factor in supporting the transition processes toward a sustainable world." But this assumes the need to promote an anthropo-centered design of work systems, services and devices, whereas the general trend (notably visible in public policies) remains based on a techno-centered vision, which suggests that techno-solutionism is the answer to a sustainable future [28].

However, is a human-centered approach sufficient to meet these challenges? How can we integrate the necessary synergies between human beings, living resources, and nature? Can we develop alternative approaches that could be vivo-centered? Indeed, SD contains inherent contradictions. On the one hand, the concept as formulated in 1987 [1] calls for an economic growth compatible with the preservation of the environment and human development. On the other hand, the thematization of the Anthropocene and the urgency posed by climate change, for example, call into question the need for a more in-depth transformation of our modes of production, consumption and living. But drawing attention to these contradictions raises a series of questions for the stance and contribution of ergonomics in the realm of SD: what does this concept, introduced in 1987, mean today? Are the three pillars that define SD sufficient for analysis and intervention? Is the scope sufficient to guide and devise research goals and interventions that take account of the urgent, shared, and systemic nature of the issues involved? The semantic and terminology used might be questioned in our disciplines to better contribute to SD: what needs to be sustainable, what needs to be developed? Does "sustainability" sufficiently encourage to consider desirability and ecosystems preservation? Does the notion of development open new ways of thinking and new forms of growth besides economic and financial ones? Is this concept sufficiently relevant and efficient to engage organizations in a paradigm that no longer pursues the sole perspectives of economic and industrial health?

Ergonomics has never adopted a specific definition of SD or its challenges. However, the work discussed within the CDSD and the key principles we have presented show that ergonomics has created and promotes a singular vision of SD. And the conference's central theme demonstrates the importance of this topic for ergonomics, and the common challenges and concerns that emerge whether the focus is on usage, activity or human factors, and regardless of a focus on design, the transformation of work or everyday situations, or training. At a time when the inner contradictions of SD are becoming increasingly perceptible and when climate, environmental, economic and social or political crises are on the rise, sharing and collectively debating how ergonomics can continue to contribute to a sustainable and desirable future is an undeniably necessary challenge to help overcome the full range of current and future ergonomics challenges.

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