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FACT SHEET

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HUMAN-CENTRED TECHNOLOGY: SOUTH AFRICAN EXAMPLES

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INTRODUCTION

In the February 2022 Fact Sheet, we explored the new normal of blended workspaces comprising physical, augmented and virtual realities. Therein we noted that there are continuing shifts in how we work, live, play, and relate to each other. In the June 2022 Fact Sheet, we outlined some of the prevailing impacts of the COVID pandemic on working, living, playing, and relating. This is against the backdrop of the 2020, 2021, and July 2022 Fact Sheets that delved into the impact of digitalisation, digital transformation, and the many technologies categorised under the fourth industrial revolution (4IR) as well as hybrid working arrangements and teams. That is, the impact of technology and technical systems on us as humans, before and during the pandemic.

In the present Fact Sheet, we will focus in on human-centred perspectives on technology design and applications in organisations. We begin by exploring what human-centredness means and then how we can define and approach human-centred technology. Thereafter we will showcase two South African examples of human-centred technology. The first is the programme entitled, Successful Application of Technologies Centred Around People (SATCAP). The second is the Post School Education and Training CLOUD (PSET CLOUD) project.

**Navigate the menu by clicking on desired heading.

HUMAN-CENTREDNESS

There are many variations on the theme of being *human-centred* or *people-centred*. For example, there are diverse fields of research and practice on the design and application of technologies that are centred around humans (Brandt and Cernetic, 1998). These may focus on the:

- ease and specific **use** of technologies by humans
- how technologies can **aid** or **augment** humans
- human **experience** of technologies, including the interface and interaction with technologies
- **integration** of technologies into our personal and working lives and their impact therein
- **benefits** and **value** of these technologies to humans and societies.

The focus of the research and practice may be narrow and circumscribed to people's work and productivity in organisations. Or it may be broader and attend to people's physical, psychological, financial, social, and spiritual wellbeing in the present and future. This means focusing on how humans can thrive, now and in the future, and not just survive. It may include considerations on the impact of technologies on the sustainability of human lives and livelihoods as well as their environments[1]. Here one could make links with the UN Sustainable Development Goals[2].

Another example is the International Labour Organisation's (ILO) framework for decent and sustainable work for humans in the 4IR future[3]. The ILO framework recommends investments in the real economy, institutions, social protection systems, labour protection, lifelong learning systems, and people and other capabilities to create decent and sustainable work and livelihoods for the future of work. The focus is on investments for sustainable work.

The above range of approaches to human-centredness illustrates the rich history of thought on human-centred policies and practices. This includes the constructive relations and symbiosis between humans and computers/machines. For example, the socio-technical systems approach, the human relations school, critical management studies, the Strategic Human Resource Management attention to the quality of working life and wellbeing, and critical approaches to Human Work Interaction Design. Thus, being human-centred does not in itself mean being against technology. It does not mean the negation or impeding of technology in the form of computing, artificial intelligence, automation, or productivity tools and techniques.

Being human-centred means paying critical attention to how technologies are impacting and could impact the quality of work, life, and experience of people. It also means shaping technologies – in its development, deployment, and adoption – to improve employment and the quality of people's work, life, experiences, and wellbeing.

1. We could suggest that a human-centred approach may be limited in appreciating all of the environmental and sustainability issues facing our planet (Brandt and Cernetic, 1998). This means that our anthropocentric perspective may neglect the impact we have on the livelihoods of other living species and their environments as well as the planet as a whole. See also post-structuralist and postmodernist critiques of our traditional philosophical conceptions of humans and the centrality of humans.
2. See the UN SDG webpage: ***https://www.undp.org/sustainable-development-goals***
3. See the May 2020 SABPP Fact Sheet: ***https://cct.mycpd.co.za/SABPP/FactSheets/2020/fact_sheet_may_2020v004-min.pdf***

HUMAN-CENTRED TECHNOLOGY: DEFINITION

The term, human-centred technology (HCT), seems to be taken as self-explanatory and is used to mean the design and application of technologies and/or technical systems that places humans or people at the centre. The term, human-centred design (HCD), appears to be used interchangeably with HCT at times. Or HCD is used as a broader concept that encompasses HCT. That is, HCT as a particular approach to the design of the interactions between humans and technologies or technical systems. Others though may invert this and see HCD as a particular approach to HCT. Complicating these discussions is how authors variously define and view technologies, technical systems, and systems generally (Boy, 2021a). Some may narrow their focus to human-computer interactions (HCI) for example. See the below Textbox 1 at the end of this subsection for an example of one heuristic guide on how the different fields on humans and technology have evolved over time. And Textboxes 2 and 3 on some of the various fields of research and practices that speak to humans, technologies, and social and technical systems.

We could use the following definition of HCD from ISO 9241-210:2019, which focuses on the ergonomics[4] of human-system interaction (Part 210: Human-centred design for interactive systems):

> "Human-centred design is an approach to interactive systems development that aims to make systems *usable* and *useful* by focusing on the **users, their needs** and **requirements**, and by applying *human factors/ergonomics*, and *usability* knowledge and techniques.

This approach enhances

- » effectiveness and efficiency,
- » improves human well-being,
- » user satisfaction,
- » accessibility and sustainability,
- » and counteracts possible adverse effects of use on human health, safety and performance" (italics, bold, and arrowed bullet points added).

We could suggest that HCT is the usability and usefulness of technologies or technical systems for users and their needs and requirements. This may be in their work and/or personal environment. However, we need to be careful of taking too a narrower view which evaluates usability and usefulness from an efficiency and effectiveness perspective only and restricts it to the individual's immediate work or task environment. We need to rather consider how social and technical systems interact, integrate, and impact each other. We need to evaluate the benefit and value of technologies and technical systems for humans and how these impact the quality of their lives, livelihoods, employment, nature of work, and wellbeing as well as the quality of their work, social, and personal environments. This includes sustainability of these, which is emphasised in the second part of the above quoted definition (see the arrowed bullet points). Relooking at the above definition we need to critically examine how the different enhancements are designed and enacted or are actually realised.

4. The roots of the term ergonomic are the Greek word 'ergon', meaning work, and 'nomic' which means laws (Collins dictionary). There appear to be various definitions of ergonomics in terms of the benchmarks or criterion for the 'laws' or relationships between people and the working environment – whether efficiency of workflows, effectiveness of tasks, economics and costs of work, health and wellbeing of workers, or quality of working life. For purposes of the present Fact Sheet, we could suggest that these differences are based on a narrow or broad focus on how humans and the work environment or systems interact and the outcomes and impacts thereof. This can be seen in the enhancements listed in the ISO definition. That is, a narrow focus on efficiency and effectiveness of tasks/work or a broader focus on work and the human being and system as a whole.

Textbox 1: Evolving approaches to human, technologies, technical systems, and their interactions

The below graphic is one heuristic guide on how some of the approaches have evolved. It is used here for illustrative purposes as a brief outline rather than a comprehensive framework.

Boy, Doule, Kiss, and Mehta (2018) provide the following descriptions of the evolution of (1) Human Factors and Ergonomics (HFE), (2) Human-Computer Interaction (HCI), and (3) Human-System Integration (HIS) which brings together the engineering of systems or systems engineering (SE) and human-centred design (HCD):

- "**HFE** was developed after World War II to *correct engineering productions* with respect to *human* factors [..] and generated the concepts of human–machine interfaces, commonly called user interfaces and operations procedures.
- **HCI** developed during the 1980s to better understand and master [human] interaction with computers; it contributed to the shift from *corrective ergonomics to interaction design*.
- **HSI** that emerged from the need of considering *human factors* during the *whole life cycle* of *systems engineering* (SE); SE and HCD combined incrementally leads to HIS" (italics and bold added, p53-54).

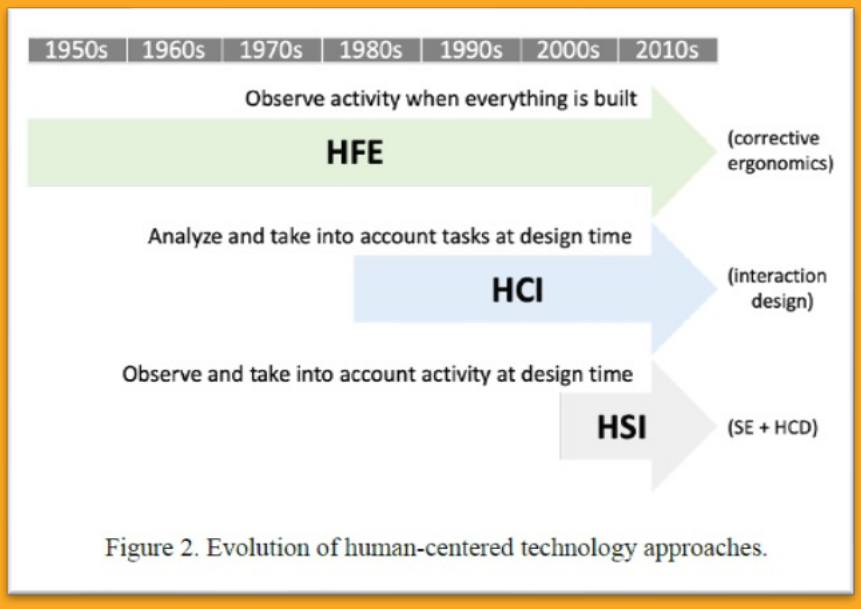


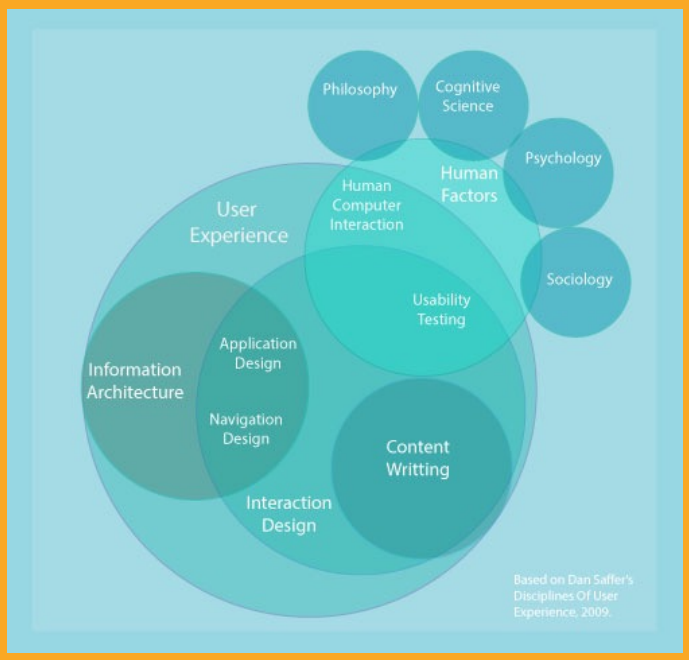
Figure 2. Evolution of human-centered technology approaches.

Source: Boy (2021b)

As noted above, there is a shift to considering human factors in the entire life cycle of the design, engineering, use, and impact of any system and the technical components, objects, hardware and software. In the next textbox we can see how various fields of research and practices can inform the design, engineering, use, and impact of systems.

Textbox 2: Fields of research and practice on humans and technology design and use

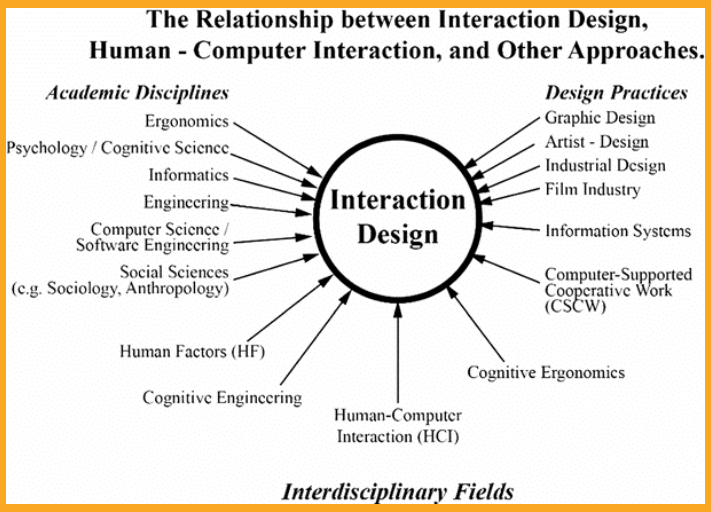
The figure is one example of the different fields of research and practices informing user experience design.



Source: ***https://digital.gov/2015/03/17/at-last-user-experience-performance-descriptions/***

Textbox 3: Various disciplines and practices informing human-technology interactions

The figure illustrates the academic disciplines and design practices informing interaction design.



Source: ***https://www.researchgate.net/figure/Relationship-between-interaction-design-human-computer-interaction-and-other-approaches_fig1_314485598***

HUMAN-CENTRED TECHNOLOGY:
POSSIBLE THEORETICAL APPROACHES

There are different academic disciplines and practice-based approaches to HCT. For purposes of this Fact Sheet, we list some of the possible theoretical approaches to HCT that could be relevant from a HR practitioner perspective. This is not a comprehensive list, but a sample of the varied approaches available to begin with.

TECHNOLOGICAL DETERMINISM

In simple terms, technological determinism assumes that technologies shape and influences humans, organisations, and societies (Fernandez, 2021). This includes how we work, relate, play, and find meaning or purpose. Thus, technology is assumed to be the force or agent of change that transforms our livelihoods as well as our work, social, and personal lives. It is also assumed to be the force that regulates the behaviour of humans, organisations, and societies.

The paradox with this form of determinism is whether it considers humans as having agency and free will. It is only if humans have agency, then we can consider the key question, that is, how we as humans adapt to the changes brought on by technologies. This we can capture as the popular phrase, 'get with the programme'. If we are already 'programmed' by technology as a regulatory force, then there is no question of whether an individual gets with a programme or not.

See page 8 of the ***February 2020 Fact Sheet*** on the different ways of conceptualising the agency of technology and humans.

SOCIO-TECHNICAL SYSTEMS (STS) APPROACH

Takes a systems view of organisations, meaning it sees the organisation as a whole system that emerges from the interrelated and interacting subsystems. The organisation as a system in turn influences and shapes these subsystems.

The two subsystems that are differentiated are the human and technical systems that comprise the organisation. The technical system includes technologies, tools, artifacts, and materials as well as techniques, processes, procedures, and spatial organisation.

These subsystems "co-produce one another — new technologies enable new possibilities for work, and new modes of work pave the way for technological change" (Winter, Berente, Howison, & Butler, 2014). With the future forms of organisations and work[5], however, the boundaries of organisations are blurring. This means that we need to attend to systems within organisational boundaries and that straddle these. And how 4IR, for example, and other trends will shape these boundaries and systems and their ecosystems[6] (Pasmore, Winby, Mohrman, & Vanasse, 2019).

HUMAN WORK INTERACTION DESIGN

Human Work Interaction Design (HWID) explores the intersection between the theories and research on (1) work and (2) interaction design in the context of the increasing adoption of information and communication technologies in smart workplaces. The HWID working group explores the interaction "among humans, their variegated social contexts and the technology they use both within and across these contexts" (no date). The intention is to understand the complex interplays between individual, social and organisational contexts. The working group suggest that the "new problem is how we can understand, conceptualise and design for the complex and emergent contexts in which human life and work are now embroiled" (ibid).

Abdelnour-Nocera and Clemmensen (2018) suggest that this approach can serve as a socio-technical approach to human-computer interaction (HCI). However, they also note that the HWID researchers and practitioners may limit the analysis of the 'social' to the workers task satisfaction with the use of ICT systems and their satisfaction with their immediate task and ICT environment.

5. See the SABPP Fact Sheet series on the future world of work: ***https://www.sabpp.co.za/knowledge-hub/fact-sheet-2021***

6. See the SABPP Fact Sheet on future forms of organisations for a discussion on ecosystem perspective: ***https://cct.mycpd.co.za/SABPP/FactSheets/2020/fact_sheet_december_2020.pdf.***

HUMAN RELATIONS APPROACH

The human relations approach is typically contrasted to Taylorism, which is depicted as focusing solely on workflows and worker efficiency and outputs (Bruce and Nyland, 2011). The human relations approach pays attention to human motivation and satisfaction as well as the formal and informal relations within the organisation.

This approach can help understand how technologies or technical systems impact on individual motivation and groups relations and dynamics and vice versa. It also points to the importance of individual and group consultation and involvement in the design and decisions on technologies and technical systems. Here, we can note the importance of the organisational culture in relation to the adoption and use of technologies.

The approach though is limited in how it addresses employee relations. For example, the power dynamics and different incentives between employees and managers/owners. It also limited in advocating worker involvement in decisions as a stakeholder. See the critical review by Bruce et al and the next discussion on critical management studies.

CRITICAL MANAGEMENT STUDIES

Critical management studies (CMS) pay specific attention to the relations of power and control. This includes marginalisation and how inclusion and diversity take form in organisations. It also attends to how sustainability is defined and approached. The specific approaches in CMS may differ based on the different critical theories the authors may use or the different ways they interpret these. The authors may explore how technologies or technical systems influence or impact on power relations and how it used to surveil and control workers. They could examine what are technologies' effects on the nature of work, marginalisation, and worker involvement and empowerment (or disempowerment). A question that could be posed is whether technologies will make work more precarious and contingent. And relatedly the question of whether employment will become precarious and contract-based or gig-work-based.

SELF-SOVEREIGN IDENTITY (SSI)

This movement and approach aims to facilitate human autonomy and agency through technologies such as blockchains and other decentralised or distributed ledger technologies (Mühle, Grüner, Gayvoronskaya, Meinel, 2018). It argues that an individual should own and control their digital identity and various credentials. Their identity should not be controlled or limited by regulatory authorities, corporates, or digital platforms such as Facebook or Google. This requires the development of decentralised identity management infrastructure to facilitate an individual's sovereignty over their identity.

In the next section on the PSET CLOUD we will see an example of the use of SSI.

CASE EXAMPLES

MANDELA MINING PRECINCT'S SATCAP PROGRAMME

https://mandelaminingprecinct.org.za/successful-application-of-technologies-centred-around-people-satcap/

The Mandela Mining Precinct is a public-private partnership between the Department of Science and Innovation and the Minerals Council South Africa. The Precinct is jointly hosted by the Council for Scientific and Industrial Research (CSIR) and the Minerals Council. The Mandela Mining Precinct is an initiative aimed at revitalising mining research, development, and innovation in South Africa to ensure the sustainability of the industry. This is achieved through the South African Mining Extraction, Research, Development and Innovation (SAMERDI) strategy.

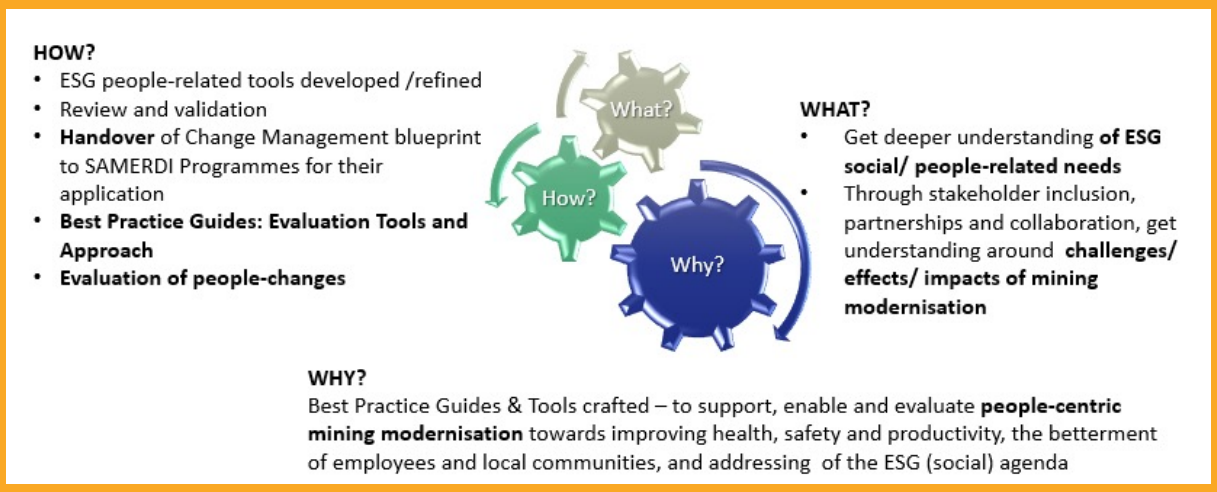
The strategy comprises six research programmes. One of these programmes is the **Successful Application of Technologies Centred Around People (SATCAP)**. The SATCAP research programme is a people-focused approach to mining modernisation and related environmental, social and governance (ESG) issues. As the mines modernise, the introduction of technologies, systems and processes will have an impact on people. SATCAP's intent, therefore, is to gain an understanding of the following:

- how people relate to each other and with technology in the process of modernisation
- the effects and impacts of modernisation on people
- people-related challenges regarding mining modernisation

Regarding the Environmental, Sustainablity and Governance (ESG) issues, SATCAP aims to unearth the people-related matters to support mining sustainability. This means a deliberate focus on the 'social or people' aspects of ESG. This is important because as the industry modernises, the social needs of the communities around the headgear of the mines become more urgent. As the mines' resources are depleted and shafts begin to close, the legacy the mine leaves behind and how communities will survive and thrive beyond mining becomes a critical issue.

SATCAP's guiding process

SATCAP has developed a guiding process to support its journey towards its 2030 vision.



Source: SATCAP

The goal of SATCAP is to contribute to a productive industry through 'sustainable relationships and shared value for people in a modernising minerals sector'. As the SATCAP research programme has a people-centric approach and seeks to take the various stakeholders along on the mining modernisation journey, it allows the opportunity for:

» stakeholder inclusion and collaboration

» sourcing views into the challenges, effects, and impacts of modernisation on people

» bringing awareness, understanding, acceptance and capacity building for mining modernisation

» investigating skills needs for mining modernisation

» seeking an understanding of the impacts on jobs and employment.

One research project explored, for example, the benefits and shortcomings of stakeholder inclusion in equipment design and development. Subsequently a guideline for the inclusion of employees in the design and development of equipment was developed: ***https://mandelaminingprecinct.org.za/wp-content/uploads/2021/08/2.-SATCAP20-WP3-summary-for-website010421.pdf***

The SATCAP programme has developed several guidelines for the industry to support mining modernisation from a people-centred approach. And it makes available applicable people-related technologies, tools, and solutions for uptake by the mines.

PSET CLOUD

https://psetcloud.org.za/

The Post-school Education and Training (PSET) CLOUD project aims to address the many disconnects in the South African education, employment, and empowerment initiatives by developing a national digital ecosystem.

"There is a big disconnect in South Africa's post-school worlds of learning and work, and this is evident from the unemployment rate – which was at an all-time high of 32.6% at the end of Q1 2021. This is why the PSET CLOUD solution is geared to connecting all participants in the post-school system and wants to help individuals go from job seekers to developing their careers" (PSET CLOUD, no date)

It aims to address the many silos in the post-school learning and working and the resulting disconnects between stakeholders and in the data and infrastructures within the country. These include the silos:

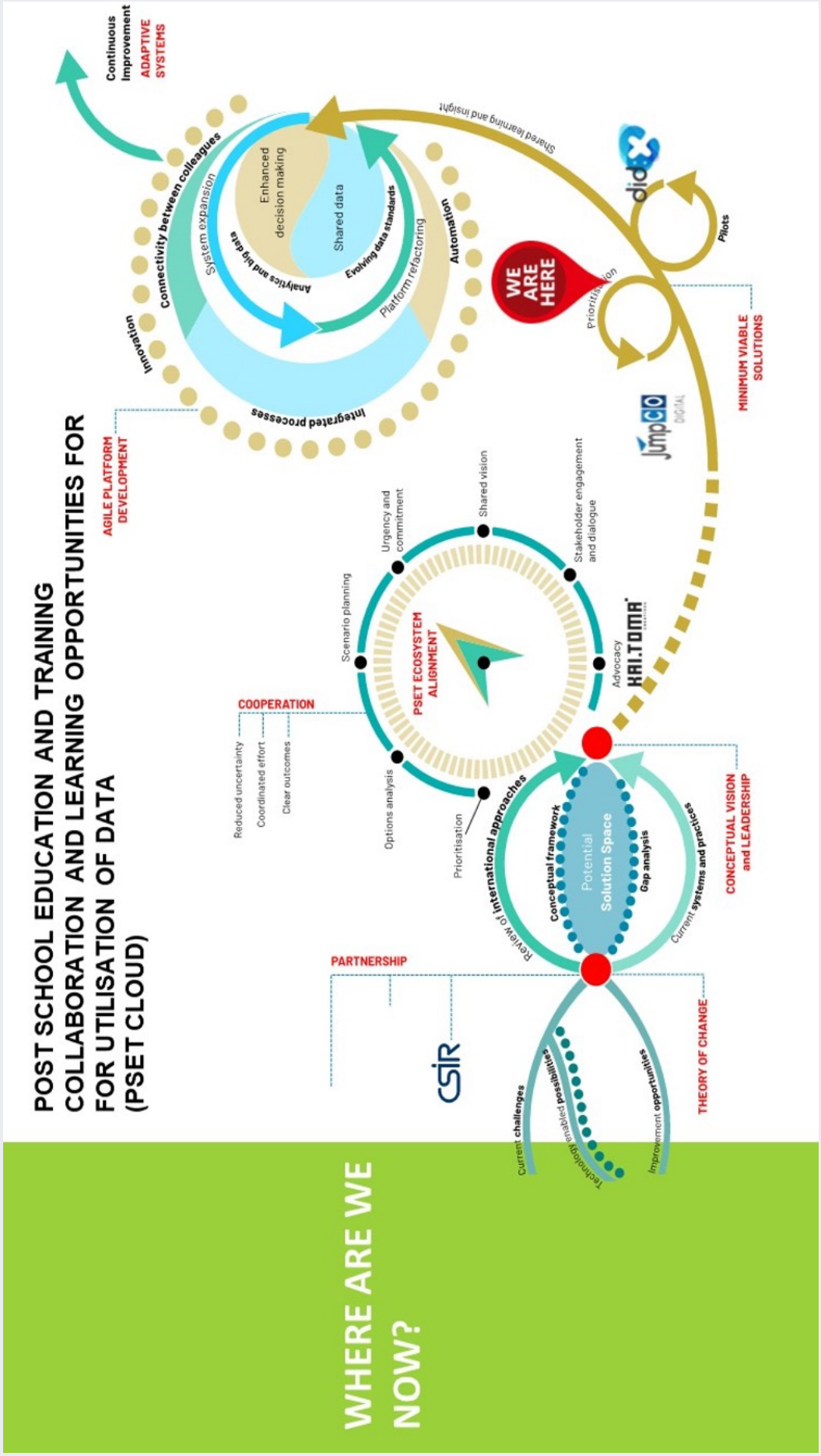
- within which stakeholders are locked in or constrained
- of post-school learning and learner data, which makes them inaccessible
- of post-school youth empowerment work initiatives
- of organisational data on learning and working
- of organisational work opportunities
- between graduate data and vacancy portals.

PSET CLOUD's aim is to use "technology to improve connections and to enable more effective alignment between all participants" (ibid). The PSET CLOUD also aims to enable individual autonomy and agency. Thus, it aims to incorporate the principles of Self-Sovereign Identity (SSI) and incorporate these in the design and development of the national data ecosystem. Individuals will control which of their credentials is shared with stakeholders in the post-school learning and working spaces.

This is an ambitious and complex national project. The roadmap illustrated on the next page gives a sense of the complexities that the PSET CLOUD team is working with in various organisational, social, and technical systems and spaces in South Africa. It portrays the journey thus far:

- articulating a theory of change and the solution space to address the disconnects
- development of the vision and leadership for the alignment of the PSET ecosystem
- defining the minimum viable socio-technical solutions.

The roadmap provides a glimpse of the many engagements and consultation with various stakeholders in the development of the solution space. It also indicates the technologies to enable this and to achieve the aims of the project. It can serve as a real-life case study of a socio-technical approach to addressing the identified disconnects.



Source: PSET CLOUD, JET Education Services (Rajab et al, 2020)

IMPLICATIONS FOR HR

The discussion and examples clearly point out that HR practitioners need to motivate their organisations to consider both the social and technical systems when designing, developing, and/or deploying technologies. This consideration is also required with the design, development, and/or deployment of HR technologies. Consultation with internal and external stakeholders is a critical aspect of the process and journey. It will help tease out what human-centred technology design, development, and deployment will mean in the specific strategy and context of the organisation. The earlier discussed examples clearly illustrate the complexities of the journey that HR needs to prepare their organisations for. The SATCAP guiding process gives an example of the why, what, and how questions that need to be deliberated and consulted on.

CONCLUSION

The Fact Sheet discusses the importance of human-centred technology, acknowledging that an anthropocentric-lens can be limiting in thinking broadly about sustainability. It highlights some of the many complexities and contestations regarding human-centredness and human-centred technology. This can be seen in the different approaches to human-centred technology. The two South Africa examples illustrate the possible complexities, challenges, and opportunities. Importantly, they emphasise our agency in shaping our world, the technologies and technical systems therein, and how we create the future forms of working, living, relating, playing, and finding purpose and meaning.

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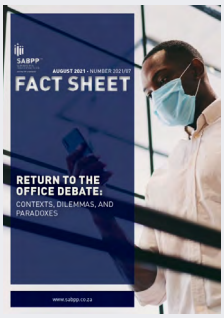

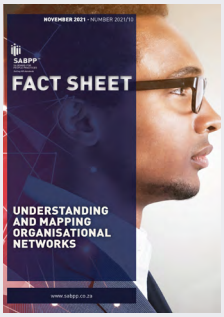

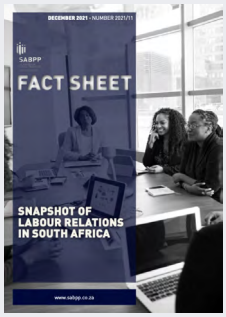

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