

From Academia to Professional Practice: Development of Key Competencies in Sustainability through the ABCD Process

**Ian Sylcox
Khanh Vy Do
Rossitsa Rousseva
Una Sprenger**



Blekinge Institute of Technology
Karlskrona, Sweden
2025

From Academia to Professional Practice: Development of Key Competencies in Sustainability through the ABCD Process

Ian Sylcox
Khanh Vy Do
Rossitsa Rousseva
Una Sprenger

Blekinge Institute of Technology
Karlskrona, Sweden
2025

Thesis submitted for completion of Master's in Strategic Leadership towards Sustainability,
Blekinge Institute of Technology, Karlskrona, Sweden.

Abstract

This research explores how the ABCD Process, a strategic planning approach within the Framework for Strategic Sustainable Development, supports the development of key competencies in sustainability in professional practice. Addressing a persistent gap between academia and professional settings, the research adopts a qualitative methodology with semi-structured interviews with two leading experts and 14 practitioners from diverse sectors and experiences. Findings indicate that the ABCD Process facilitates the cultivation of all eight KCs with varying prominence and context-dependence. Planning Competencies emerge mostly in specific steps, e.g., the A-Step fosters Systems, Futures, and Values Thinking, while the D-Step supports Strategies Thinking. In contrast, Interpersonal, Intra-personal, and Integration Competencies develop across the whole process. Implementation Competency was least supported, often requiring additional steps for its activation. Practitioners highlighted the flexibility of the ABCD Process but also shared different views on recognizing competencies. Experts emphasized the process' theoretical grounding in transdisciplinary, stakeholder-driven designs. Limitations include a deductive design that may constrain emergent themes, uneven familiarity with key competencies among interviewees, and absence of standardized competency assessment. Future research could explore co-designing ABCD Process adaptations with practitioners to enhance specific competencies and develop robust, context-sensitive evaluations.

Key Words: ABCD Process, Sustainability Key Competencies, Sustainability Professional Practice, Strategic Sustainable Development, Competency Development, Sustainability Practitioners

Statement of Contribution

Our team’s success stemmed from a mixture of complementary skills, working styles, and a shared, strong commitment. We worked as much as possible in person, holding regular alignment and team process sessions. This collaborative working model created a sense of trust and shared ownership in our group and ensured alignment of team dynamics. All team members took part in the development and execution of each part of our thesis, based on their strengths and interests.

Ian has been the backbone of consistency in our team. His calm demeanor has fostered a supportive environment, balancing moments of stress. He contributed to tangible aspects of the research taking part in the development of the Introduction, Background of Fields, Phase 1 Results, and Methods sections, as well as responsibility for administrative tasks along the process. His calm and steady presence brought grounding and helped maintain the mental health and stability of the group.

Khanh Vy was the analytical head of the team, providing the group with robust data analysis. She created documents and systems that structured the work of the whole team such as our coding master file and more. Her work in the team helped us maintain momentum and focus while ensuring quality and clarity in scope. She played a key role in designing the interview strategies, flow, and conducting interviews, ensuring thorough and effective data collection. Her in-depth work on the Methods, Results, and Discussion sections, along with her systematic follow-through, played a key role in maintaining the team’s momentum.

Rossy’s contributions are defined by meticulous analysis and a willingness to challenge assumptions. She anchored our work to the research question and purpose, bringing depth and motivation to discussions. She played a key role in shaping the interview content, flow, and facilitation structure, together with supporting the Introduction, Background, Phase 2 Results, and Discussion writing. Rossy brought a lot of intangible contributions such as a high level of depth, curiosity, and critical thinking. Her positive mindset sparked in the group and kept our attitude high.

Una’s strengths in organizing and structuring both content and process were invaluable to our thesis writing. She was able to define processes and methods that suited the research purpose, while ensuring high quality and consistency. She often provided logic and primary structure to the tasks at hand and took the lead in our work sessions. She contributed meaningfully to data collection and analysis, which informed our key findings, as well as writing large parts of Introduction, Methods, and Results. Her creativity and passion played a strong role in discussions, bringing energy and movement into the group.

The thesis writing process has been a learning journey not only in terms of academic research but also in collaborative leadership in complexity. Whenever challenges did occur, we were able to transform them into opportunities for growth. Our strengths and shared commitment to this project have made our team both effective and inspiring to be part of.



Ian



Khanh Vy



Rossy



Una

Acknowledgements

The completion of this thesis was only made possible by the support of numerous individuals, and we wish to express our gratitude to all who have contributed to this endeavor.

We wish to extend gratitude to our primary supervisor, **Dr. Merlina Missimer**. Her consistent support, especially her level of detail and motivation, was significant in shaping the development and successful completion of this thesis. The clarity and direction she provided during our weekly meetings and in her feedback on the various drafts helped us uphold a high standard of academic work. Dr. Missimer's dedication to our research and the Master's program made our thesis writing journey an experience full of insights and learnings, providing an excellent foundation for academic growth.

Sincere appreciation is also extended to our secondary advisor, **Pierre Johnson**. His critical feedback and incisive questions were of the utmost help in refining the scope, direction, and overall development of this research.

We extend our sincere thanks to the **two experts** and **14 practitioners** who generously shared their time, experiences, and insights. Their thoughtful contributions were essential to the richness and depth of this research.

We also wish to acknowledge the faculty, staff, and our beloved fellow classmates in the MSLS program for their support throughout our studies. The collaborative coursework and engaging discussions enriched our learning experience and contributed to our research. We are appreciative of the scholarly community and the professional relationships fostered.

Finally, we are grateful for our families and friends. Their support, patience, and encouragement created the foundation upon which this thesis was made possible. Though their contributions may not appear in citations, their presence was a constant source of strength and resilience throughout this journey.

List of Abbreviations (Alphabetical Order)

Abbreviation	Explanation
CEO	Chief Executive Officer
CSR	Corporate Social Responsibility
ESD	Education for Sustainable Development
UFCAST	Unified Framework of Competencies for Advancing Sustainability Transformations
FSSD	Framework for Strategic Sustainable Development
GDPR	General Data Protection Regulation
IPCC	Intergovernmental Panel on Climate Change
KC(s)	Key Competency(ies)
MSLS	Master's in Strategic Leadership towards Sustainability
NGO	Non-Governmental Organization
SD	Sustainable Development
SDGs	Sustainable Development Goals
SPs	Sustainability Principles
SS	Sustainability Science
SSD	Strategic Sustainable Development
UN	United Nations

Legend Table for Key Competencies

Abbreviation	Key Competency
KC1	Systems Thinking Competency
KC2	Futures Thinking Competency
KC3	Values Thinking Competency
KC4	Strategies Thinking Competency
KC5	Implementation Competency
KC6	Interpersonal Competency
KC7	Intra-personal Competency
KC8	Integration Competency

Table of Contents

1	Introduction	1
1.1	Sustainability Challenge	1
1.2	Need for Sustainability Leadership	1
1.3	Key Competencies in Sustainability	2
1.4	Gap between Academia and Professional Settings	3
1.5	ABCD Process	3
1.6	Purpose, Research Question, and Scope	4
2	Background of Fields	5
2.1	Sustainability Science	5
2.2	Strategic Sustainable Development	6
2.2.1	Background of Strategic Sustainable Development	6
2.2.2	Need for a Strategic Approach towards Sustainability	6
2.2.3	Framework for Strategic Sustainable Development	7
2.2.4	ABCD Process	7
2.3	Key Competencies in Sustainability	8
3	Methods	12
3.1	Qualitative Methodology	12
3.2	Research Design	12
3.3	Phase 1: Analysis of Current Academic Discourse	12
3.3.1	Preparatory Conceptual Mapping using Academic Literature	12
3.3.2	Interviews with Experts	13
3.4	Phase 2: Analysis of Current Professional Practice	16
3.4.1	Interviews with Practitioners	16
3.5	Research Quality and Ethical Consideration	19
4	Results	21
4.1	Results from Phase 1: Interviews with Experts	21
4.1.1	Systems Thinking (KC1)	22
4.1.2	Futures Thinking (KC2)	22
4.1.3	Values Thinking (KC3)	23
4.1.4	Strategies Thinking (KC4)	24
4.1.5	Implementation Competency (KC5)	25
4.1.6	Interpersonal Competency (KC6)	25
4.1.7	Intra-personal Competency (KC7)	26
4.1.8	Integration Competency (KC8)	26
4.1.9	Other Results	27
4.2	Results from Phase 2: Interviews with Practitioners	27
4.2.1	Systems Thinking (KC1)	28
4.2.2	Futures Thinking (KC2)	29
4.2.3	Values Thinking (KC3)	30
4.2.4	Strategies Thinking (KC4)	32
4.2.5	Implementation Competency (KC5)	33
4.2.6	Interpersonal Competency (KC6)	34
4.2.7	Intra-personal Competency (KC7)	35
4.2.8	Integration Competency (KC8)	36
4.2.9	Other Results	37
5	Discussion	38
5.1	Detailed Discussion per Key Competency	38

5.1.1 Systems Thinking (KC1).....	38
5.1.2 Futures Thinking (KC2)	39
5.1.3 Values Thinking (KC3)	40
5.1.4 Strategies Thinking (KC4)	40
5.1.5 Implementation Competency (KC5)	42
5.1.6 Interpersonal Competency (KC6).....	43
5.1.7 Intra-personal Competency (KC7)	43
5.1.8 Integration Competency (KC8)	44
5.2 Overall Discussion ABCD Process & Key Competencies	45
5.3 Limitations and Further Research	47
6 Conclusion	50
7 References.....	51
8 Appendices	57

List of Figures and Tables

List of Figures

Figure 2.1. UFCAST; centered on 8 KCs with 5 established (bold) and 3 emerging (italic); complemented by disciplinary, general, and other professional competencies. From Redman and Wiek (2021).....	11
---	----

List of Tables

Table 2.1. Definitions of ABCD Process steps, adapted from Broman and Robèrt (2017).....	8
Table 2.2. Definition and most common descriptors from the literature for each KC from Redman and Wiek (2021).	10
Table 4.1. Expert-informed conceptual heatmap. For details & legend see section 3.3.2.	21
Table 4.2. Practitioner-informed conceptual heatmap. For details & legend see section 3.4.1	27
Table 5.1. Heatmap Comparison of Experts & Practitioners: Systems Thinking.....	38
Table 5.2. Heatmap Comparison of Experts & Practitioners: Futures Thinking.	39
Table 5.3. Heatmap Comparison of Experts & Practitioners: Values Thinking.	40
Table 5.4. Heatmap Comparison of Experts & Practitioners: Strategies Thinking.	40
Table 5.5. Heatmap Comparison of Experts & Practitioners: Implementation Competency. .	42
Table 5.6. Heatmap Comparison of Experts & Practitioners: Interpersonal Competency.	43
Table 5.7. Heatmap Comparison of Experts & Practitioners: Intra-personal Competency.	43
Table 5.8. Heatmap Comparison of Experts & Practitioners: Integration Competency.	44

1 Introduction

1.1 Sustainability Challenge

Almost forty years ago a definition of sustainable development (SD) was born out of the Brundtland Report stated as “... development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission On Environment And Development 1987). However, since the formation of this definition, evidence has pointed to continued unsustainable development. Human activity has been increasingly linked to threatening different interrelated earth systems past their thresholds for capacity of resiliency to withhold human interference (Steffen et al. 2015). The Intergovernmental Panel on Climate Change’s (IPCC) 2023 report has emphasized this point by presenting how human activity, specifically the emissions of greenhouse gas, is the main contributor to the heightened trends of global warming and climate change (Calvin et al. 2023). Alongside climate change, the degradation of biodiversity and ecosystems, and the benefits they provide to society, is accelerating, diminishing their capacity to contribute to human well-being and doing so in increasingly unjust ways (IPBES 2019). In parallel, social systems are also becoming unsustainable, as fundamental concepts such as trust (Missimer et al. 2017), fail to meet necessary thresholds in key institutions like business, government, media, and Non-Governmental Organizations (NGOs) (Edelman 2025).

The sustainability challenge is further compounded by the complexity of nested and interconnected systems, ecological, social, and economic, which are globally intertwined, meaning that effective solutions must address root causes at the highest systemic level (Liu et al. 2015; 2007). As human society and activity continue to increase activity that degrades ecological and social systems systematically, the complexity of these interconnected systems enhances the complexity of the challenges society faces. An important metaphor from Broman and Robèrt (2017) called the Funnel Metaphor can help emphasize the urgency of the culmination of these negative impacts. The Funnel Metaphor illustrates that as human activity continues to systematically degrade ecological and social systems, the capacity of these systems to support human well-being declines, reducing people’s ability to live prosperous lives and adapt to unforeseen shocks.

1.2 Need for Sustainability Leadership

To address these complex, interconnected, and evolving systems and sustainability challenges, scholars have emphasized that traditional leadership models are often an inadequate response (Metcalf and Benn 2013; Sajjad et al. 2024). Metcalf and Benn (2013) argue that sustainability challenges demand leadership capable of interpreting and engaging with complex adaptive systems, both within and outside organizations. Sajjad et al. (2024) reinforce this view, showing how sustainability leadership must operate across individual, organizational, and societal levels, navigating the tensions inherent in simultaneously pursuing environmental, social, and economic goals.

This emerging view of sustainability leadership focuses less on positional authority and more on the capacity to address interconnected risks, value long-term impacts, and respond to uncertainty. Fry and Egel (2021) propose that cultivating a “global mindset for sustainability”

grounded in ethics, interconnectedness, and care is essential for leaders navigating global-scale sustainability threats. These qualities reflect the need to engage with the interlinked nature of social and ecological breakdown identified earlier.

This shift is also reflected in efforts to rethink leadership preparation. Lozano et al. (2013) emphasize that institutions of higher education must move beyond reductionist approaches and actively foster new leadership capacities across curricula, operations, and stakeholder engagements. Similarly, Shapira et al. (2017) propose integrating sustainability principles into design processes as a way to foster systemic awareness and innovation toward sustainable outcomes. Recognizing the need for sustainability leadership invites the question of how such leadership can be developed. To lead effectively in complex and dynamic contexts, individuals must be equipped with specific competencies that enable them to drive sustainability transitions (Redman and Wiek 2021; Giangrande et al. 2019).

1.3 Key Competencies in Sustainability

What, then, are the competencies sustainability professionals need to lead the required transition? Sustainability professionals should be equipped both with knowledge and the ability to navigate the complexity of sustainability through adaptable and systemic approaches (Redman and Wiek 2021). Giangrande et al. (2019, 3) state that “instead of focusing on the information, or even on skills acquisition, a more pragmatic yet meaningful strategy is to focus on the attributes, capacities or competencies acquired by learners”. Distinct competencies are needed to deal with the complex sustainability challenge humanity is facing (Lans et al. 2014; Wals and Jickling 2002; Tejedor et al. 2019). Chief Executive Officers (CEOs) worldwide support this approach, promoting that specific competencies are required when faced with the sustainability challenge (Accenture 2010). Osagie et al. (2016, 234) further point out that the competencies of professionals who account for implementing corporate social responsibility (CSR) into business processes “will also likely influence the company’s CSR performance in addition to important institutional and organizational factors and processes”.

It is therefore relevant for research and practice to have a framework of competencies that offers a shared language. This helps educators to evaluate learning progress and teaching effectiveness (Wiek et al. 2011), companies to select suitable job applicants, and professionals to focus on their development to better implement sustainability (Osagie et al. 2016). Realizing this need for a unified framework and acknowledging the lack of guidance from (international) policy, Wiek et al. (2011) proposed in 2011, with an update in 2021 (Redman and Wiek 2021), the Unified Framework of Competencies for Advancing Sustainability Transformations (UFCAST).

The UFCAST consists of the five established competencies (Systems Thinking, Anticipatory, Normative, Strategic, and Interpersonal), and three emerging (Intra-personal, Implementation, and Integration) in complementation with disciplinary, general, and other professional competencies (Redman and Wiek 2021). This categorization of competencies into clusters of key competencies (KCs) is recognized as “a useful approach to enable contextualization and development of specific competencies whilst ensuring categories are maintained” (Giangrande et al. 2019, 5).

1.4 Gap between Academia and Professional Settings

Much of the literature on the UFCAST centers on its application in academic and educational contexts (Osagie et al. 2016). Many university sustainability programs are designed to develop the KCs, but graduated students often struggle to articulate these competencies in professional settings (Brundiars et al. 2021). While sustainability challenges require a set of competencies that go beyond theoretical knowledge (Wiek et al. 2011), work-related competencies, such as decision-making under constraints, balancing trade-offs, and responding to real-world complexities, are difficult to teach in a scholastic setting (Gulikers et al. 2008). These capacities are instead developed through professional practice and experience of real-world challenges (Roe 2000). Additionally, professionals need to rely on proactive engagement in sustainability work, yet academic programs do not always use this hands-on learning approach (Osagie et al. 2016).

Despite the recognition of these challenges, there is still limited empirical research on how KCs are developed in professional settings. Brundiars et al. (2021) have begun mapping the UFCAST with five approaches for integrated sustainability problem-solving, showing how certain competencies are activated at different stages. However, the operationalization of these transformational frameworks for sustainability in private, nonprofit, and governmental organizations is still in its early stages (Wiek and Lang 2016; Redman and Wiek 2021). Other studies have examined the competencies involved in implementing CSR, but have mostly focused on early-stage adoption rather than long-term processes of sustainability integration (Osagie et al. 2016).

Given these gaps, it is important to further understand how KCs are developed in non-academic settings and to examine more solution-oriented approaches. One way to explore this is similar to Brundiars et al. (2021) use of structured planning tools that aim to integrate sustainability and sustainability principles into practice. The ABCD Process offers such context for investigating how KCs are operationalized through real-world problem-solving.

1.5 ABCD Process

The ABCD Process, part of the Framework for Strategic Sustainable Development (FSSD), is another approach to the ones discussed in Brundiars et al. (2021) paper, which aims for integrated sustainability problem-solving. It is a structured, science-based planning approach that operationalizes backcasting from a principle-based definition of sustainability (Broman and Robèrt 2017). Through backcasting (A- and B-Step), brainstorming solutions (C-Step), and prioritizing solutions (D-Step), the ABCD Process focuses on addressing progress towards envisioned sustainable futures, supporting strategic decision-making, risk and opportunities assessment, and long-term planning while remaining feasible and adaptable under real-world complexity constraints. The ABCD Process also benefits from its foundation in being a general, collaborative, and transdisciplinary approach that allows for the involvement of various stakeholders, other models, theories, and forms of support, while providing structured means to navigate sustainability challenges (Ibid).

1.6 Purpose, Research Question, and Scope

Previous research has explored and investigated the development of KCs in various approaches for integrated sustainability problem solving (Brundiers et al. 2021). The purpose of this research is to contribute to additional exploration of how strategic planning processes, particularly the ABCD Process, can support the development and application of the KCs needed for sustainability leadership. Our research question is:

In what ways does the ABCD Process facilitate the development of key competencies in sustainability in professional practice?

This research is situated within the evolving field of Sustainability Science (SS) in the intersection of sustainability education, leadership, and strategic planning in professional contexts. The primary audiences for this thesis are practitioners, sustainability educators, and researchers interested in bridging the gap between educational frameworks and strategic sustainability implementation. The research specifically investigates how the ABCD Process, an implementation procedure within the FSSD, supports the development of KCs. The selected frameworks were chosen based on the research team's proximity to relevant academic literature, practitioners within the Master's in Strategic Leadership towards Sustainability (MSLS) network, and direct experience with the ABCD Process. These boundary conditions helped keep the scope feasible within the limited time frame of the research project.

Throughout the research, development in relation to the KCs was defined as a spectrum for practitioners that ranges from learning, or acquiring knowledge and familiarity with the competencies themselves, to application, or the practical and self-realized use of the defined competencies in their work. This research seeks to generate insights that are transferable across contexts by identifying broader patterns and interconnections that can inform both sustainability education and professional development practices. While the focus is situated within the lens of the ABCD Process, the intention is to use it as a practical case to better understand the academia-professional setting relationship in sustainability competency development, rather than to generalize findings to all strategic planning processes.

2 Background of Fields

The following section situates the research within the field of SS which frames the background of Strategic Sustainable Development (SSD) as well as the relevance of the UFCAST and the ABCD Process, whose connections were explored. It provides an overview of how these frameworks emerge in response to the needs of the SS field for actionable, transdisciplinary approaches to complex sustainability challenges.

2.1 Sustainability Science

SS is a transdisciplinary field developing problem-driven research to address complex contemporary sustainability challenges. It is described as “use-inspired basic science” that focuses on understanding human-environment interactions, linking knowledge to action, and adopting inter- and transdisciplinary approaches (Fang et al. 2018).

SS’s coupled systems approach seeks to understand the interactions between human and natural systems. Turner frames the same idea of human-nature interaction as “anything that fits under the rubric of how humankind is altering the basic structure and function of the Earth’s system...is a critical problem that ought to be studied” (Turner as quoted in Miller 2013, 285). Furthermore, Kajikawa et al. (2014) observe a shift in sustainability research, moving away from studies focused on isolated targets and towards investigating coupled systems, particularly social-ecological systems.

SS’s development emerges in response to having to deal with so-called “wicked problems” – problems that are urgent, complex, and lacking in straightforward solutions (Rittel and Webber 1973). To tackle them, “the field generates, integrates and links use-inspired knowledge to transformational action in participatory, deliberative, and adaptive settings” (Wiek et al. 2011, 203).

Kates (2016) highlights that SS is inherently normative and solution-oriented, with a research agenda shaped by the problems it seeks to solve rather than by disciplinary boundaries. “Sustainability science aspires to link knowledge to social actions that advance visions of natural and social wellbeing” (Miller 2013, 279). As a problem-driven and solutions-oriented field, SS emphasizes the interconnectedness of sustainability issues, recognizing that effective solutions require considering the values and perspectives of different disciplines and world views (Lang et al. 2012). SS broadens the understanding of sustainability transitions by considering further the normative and procedural aspects of sustainability. As Nagatsu et al. (2020) highlight, SS is a values-laden field that incorporates ethical reflections, governance structures, and the role of values in shaping sustainability agendas.

While SS defines the field that seeks understanding and addressing sustainability challenges, it also highlights the need for guidance toward action within this complexity. One such guiding approach is SSD.

2.2 Strategic Sustainable Development

2.2.1 Background of Strategic Sustainable Development

As stated in the introduction, the definition of SD was introduced through the Brundtland Commission. There are numerous variations of this definition but the principle behind these variations remains similar to that of the definition from the Brundtland's Commission in emphasizing the responsible evolution of human society within socio-ecological systems, from an economic perspective (Glavič and Lukman 2007).

SD, since its introduction, has gained greater traction on a global scale through initiatives like Agenda 21, the Millennium Development Goals, and most recently, the United Nations (UN) Sustainable Development Goals (SDGs). These efforts have helped bring sustainability into mainstream discourse, influencing national policies, business strategies, and academic programs (Sachs 2013). However, despite these developments, the world remains on an unsustainable trajectory (Rockström et al. 2009; Calvin et al. 2023). Planetary systems continue to be degraded, greenhouse gas emissions have not stabilized, and biodiversity loss is accelerating (IPBES 2019).

The persistence of these trends has led scholars to question the effectiveness of SD in its implementation (Redclift 2005; Loiseau et al. 2016). Redclift (2005) argues that the Brundtland definition, while powerful in a normative sense, lacks specificity and allows for conflicting priorities, enabling unsustainable practices to persist while remaining under the guise of "development". Loiseau et al. (2016) highlight that SD often reverts to a vague balance between economic, social, and environmental goals, also referred to as the "triple bottom line". These concerns emphasize challenges related to fragmented implementation and trade-offs and are witnessed in frameworks like the SDGs (Kroll et al. 2019).

In addition, the SDGs, though widely adopted, have also faced criticism. Their broad and sometimes contradictory goals make it difficult to coordinate actions and accountability, especially when trade-offs among goals aren't managed (Eisenmenger et al. 2020; Nilsson et al. 2018; Kroll et al. 2019). Other scholars have noted that many efforts to promote SD remain aspirational, and lack the integration, foresight, and systems thinking needed to bring impactful and lasting change (Kanie and Biermann 2017).

In this context, it becomes clear that while the concept of SD has succeeded in raising global awareness and setting high-level goals, the translation of these goals into effective, long-term action has fallen short. This gap between intention and reality is explored further in the following section to evaluate the need for more strategic approaches to SD.

2.2.2 Need for a Strategic Approach towards Sustainability

As presented above, the global awareness and push for SD has encountered significant implementation barriers, particularly in translating broad goals into actionable, long-term strategies (Baumgartner and Korhonen 2010; Ngo et al. 2019). A core component of these barriers or stagnation is the lack of structured, long-term strategic thinking and strategies that integrate sustainability into organizational and societal planning (Baumgartner and Rauter 2017). Scholars have called for and proposed the integration of strategic thinking into frameworks and approaches to SD that offer tools and principles to guide purposeful, systematic transitions (Broman and Robèrt 2017; Robèrt et al. 2002).

The importance of strategic thinking in SD is emphasized by Baumgartner and Korhonen (2010), who argue that reductionist approaches often lead to trade-offs and problem displacements rather than comprehensive resolutions. They advocate for embedding strategic dimensions of content, process, and context, into sustainability efforts to better navigate complexity and avoid unintended or unforeseen consequences. Baumgartner and Rauter (2017) further this discussion by arguing that aligning sustainability with these strategic dimensions allows for businesses to generate shared value for both society and the environment. In line with this, Naudé (2014) highlights that sustainability is often managed as a stand-alone initiative rather than an integrated strategy. Strategic thinking therefore becomes essential for embedding sustainability into core business functions and long-term planning.

Collectively these works establish that SD must not only be a normative process and goal, but a strategically guided process. The integration of strategic frameworks with long-term thinking and systemic planning is increasingly seen as essential for achieving meaningful and durable progress toward sustainability (Naudé 2014; Khalili and Melaragno 2011). An avenue to this integration is through transformational sustainability research, which promotes collaborative and transdisciplinary methodologies to enable the co-design of solutions and navigation of complexity (Wiek and Lang 2016). One such approach that takes on these characteristics is the FSSD.

2.2.3 Framework for Strategic Sustainable Development

The FSSD emerged as a response to the need for a strategic approach towards sustainability. This framework and its components originate from seeking to help examine tools and approaches towards sustainability from a systems perspective to build an understanding of how they can work in unison to create positive progress toward sustainable development (Robèrt et al. 2002). Over time it grew to become a structured framework for organizations to foster a cohesive understanding of the global sustainability challenge, their positioning within this challenge, and how to progress strategically towards a sustainable future (Broman and Robèrt 2017). The core of the FSSD is its principle-based definition of sustainability (Ibid) which works to address the ambiguity and lack of clear understanding and language surrounding the term “sustainability” (Kates et al. 2001). The principle-based definition aims to eliminate the “basic mechanisms of systematic degradation of essential aspects of both the ecological and the social systems” (Missimer et al. 2017, 9). To address these mechanisms of systematic degradation there are three ecological and five social principles, referred to as the Sustainability Principles (SPs), set up as boundary constraints to guide an understanding of what can and cannot be included in a sustainable society. Along with the principle-based definition FSSD includes strategic tools like the ABCD Process, which facilitates step-by-step practical implementation of strategic planning towards sustainability, the Five Level Model, and the Funnel Metaphor (Broman and Robèrt 2017; Robèrt et al. 2002). These are used in conjunction to aid organizations in understanding and positioning themselves within the context of the sustainability challenge, and how to move forward towards positive sustainability progress (Broman and Robèrt 2017).

2.2.4 ABCD Process

While originally referred to as the “ABCD Procedure”, this thesis adopts the term “ABCD Process” to reflect its function as a strategic planning approach. The term still refers to the same four-step strategic planning approach within the FSSD.

The ABCD Process is a strategic planning process that falls within the tool kit of the FSSD. It is an essential application procedure within FSSD “for creative co-creation of strategic transitions, i.e., a procedure that supports execution of backcasting planning and redesign for sustainability” (Broman and Robèrt 2017, 23). It is intended to be utilized as an iterative process that serves best if repeated regularly and involves people from various teams and departments of an organization (Wälitalo et al. 2020). The process relies upon the concept of backcasting from an envisioned future and enables those who use it to help establish the creative tension between their current position and their future vision. It incorporates brainstorming and prioritization to understand how different, creative pathways can be taken and formalized through strategic goals to reach a future vision. According to Broman and Robèrt (2017) the ABCD’s four defined steps are presented in Table 2.1.

Table 2.1. Definitions of ABCD Process steps, adapted from Broman and Robèrt (2017).

A-Step	This step involves teaching participants about the sustainability challenge, risks and opportunities, and about the FSSD and ABCD as a whole. It then enables participants to define their core ideology (i.e. their vision of success, core values, and core purpose) within the framing of the SPs laid out in the FSSD.
B-Step	This step has participants analyze their current practices and procedures within the organization and evaluate them based on their potential contributions to violations of the SPs. The step also includes assessing current practices and procedures that are of importance in addressing any current violations or that can enable future progress towards their sustainability visions laid out in the A-Step.
C-Step	This step has participants carry out creative methods to brainstorm and identify potential solutions in bridging the gap between their current reality (B-Step) and their vision of success (A-Step). All constraints, be it financial, ecological, or social, are to be disregarded with the only constraint being that the solution is viable within the boundaries of the SPs.
D-Step	This step has participants prioritize their harvested solutions and brainstormed ideas from the C-Step based on three preliminary strategic guidelines. The three prioritization guidelines are that the solution enables a (1) flexible platform for future steps and solutions that would lead and support sustainability transition, while taking into account a balance between the (2) pace of progression towards the vision and the (3) return on investment.

As a process driven by strategic thinking, continuous iterations, and cross-organizational engagement the ABCD Process relies on the involvement of people who can navigate complexity, utilize diverse perspectives, and facilitate collaborative processes. It therefore requires specific personal and professional skills to help advance sustainability in practice.

2.3 Key Competencies in Sustainability

To move beyond fragmented or reductionist efforts in SD, scholars have emphasized the importance of integrated problem-solving and structured planning approaches (Brundiens et al. 2021; Wiek and Lang 2016). A key enabler for such approaches is Education for Sustainable Development (ESD), which was recognized in 1992 as essential for a more sustainable future in Agenda 21 (United Nations 1992).

Different programs aimed at fostering ESD, e.g. the “UN Decade of Education for Sustainable Development” (2005-2014) and “The Global Action Programme” on ESD (2015-2019), to

contribute to reaching the SDGs (Grossek et al. 2019). ESD aims to empower change agents with “knowledge, skills, values and attitudes to take informed decisions and make responsible actions for environmental integrity, economic viability and a just society empowering people of all genders, for present and future generations, while respecting cultural diversity” (UNESCO 2020, 8).

Over time, the emphasis of ESD has shifted from providing knowledge and isolated skills towards cultivating capacities that support learners in navigating complexity and driving change. As Giangrande et al. (2019) suggest meaningful education focuses on developing learners’ attributes and competencies rather than simply transmitting information. Despite its wide international popularity, ESD has often lacked concrete guidance on how to develop such capacities in practice. As Mochizuki (2016) notes, global policies like the UNDES and SDG 4.7 do not provide explicit learning objectives or actionable transformation guidelines.

Furthermore, researchers have worked to identify which competencies are most important to support real-world sustainability work across both academic and professional settings. For example, Osagie et al. (2016) highlight that individual competencies have a significant influence on the success of sustainability initiatives, such as CSR, in organizations. This convergence in the educational and professional spheres has underlined the work on the development of frameworks that identify which competencies are most critical for sustainability in practice.

The UFCAST acknowledges this need, as it aims to “guide faculty, students, and practitioners in their joint efforts to advance transformations towards sustainability” (Redman and Wiek 2021, 1). The competencies presented in it are called Key Competencies in Sustainability to ensure distinction from other key competencies in the field. Moreover, they offer a clustering of related competencies, e.g., Futures Thinking includes competencies regarding vision and scenario development (Redman and Wiek 2021; Brundiers et al. 2021). Throughout the research we refer to these Key Competencies in Sustainability as KCs, as already introduced above.

This framework, initially proposed by Wiek et al. (2011) was not only the first of its kind (Redman and Wiek 2021) but also analyzed as “the most influential paper” in ESD (Grossek et al., 2019, 26). Still, to date, it has the highest citation number in the field with 3474 citations in Google Scholar (March 07, 2025). The KCs are applied worldwide in sustainability courses and programs (Foucrier and Wiek 2019), linking efforts in education, science, and society for transforming towards the SDGs (Redman and Wiek 2021). The framework is “based on competence as problem-solving capacity, specified as sustainability research and problem-solving competence” (Wiek et al. 2011, 204).

Through a systematic literature review in Higher Education, Wiek et al. (2011) synthesized the broad discussion on competencies in ESD into five established ones, Systems Thinking, Anticipatory, Normative, Strategic, and Interpersonal Competency. The latest update from Redman and Wiek (2021) includes three more KCs – Intra-personal, Implementation, and Integration Competency – as well as disciplinary, general, and other professional competencies as complementation. Definitions and updated names for the KCs are stated in Table 2.2 below. In this work, the term “competency” is used, defined as “a complex combination of knowledge, skills, understanding, values, attitudes and desire which lead to effective, embodied human action in the world, in a particular domain” (Crick 2008, 313), as the term is most widely used and stated in the work of Redman and Wiek (2021).

The KCs are defined as a framework, shown in Figure 2.1, and they need to be comprehended not individually but in an integrated manner as they are interdependent. The Planning Competencies combine Systems Thinking, Futures Thinking, Values Thinking, and Strategies Thinking. Redman and Wiek (2021) discussed Systems Thinking as the most established KC in that group, while it is less transformative. The other three are less established, but critical for disruptive change (Chen and Hsu 2020). They are the foundation for sustainability leaders to envision sustainable futures and formulate effective and efficient action plans to reach them. Of the Key Professional Competencies (Inter- and Intra-personal Competency), the Interpersonal Competency is the established one, while the Intra-personal Competency is more unconventional (Shephard 2008; Frank 2021) and defined differently than the other KCs (Shephard et al. 2019; Gómez-Olmedo et al. 2020). It emphasizes self-awareness and self-care (Ayers et al. 2023; Redman and Wiek 2021), which are not included in traditional learning objectives or competency definitions and addresses a broader educational gap in preparing students emotionally, not only intellectually, for sustainability work (Alvarez and Rogers 2006). Implementation Competency and Integration Competency are also more unconventional – Implementation Competency is needed for “doing” sustainability, and the Integration Competency ensures the connection between all KCs in a holistic understanding. All KCs work across intercultural contexts, professions, and disciplines; they are independent of scale and discipline-specific topical knowledge and are complemented by other key content-dependent disciplinary competencies such as general (e.g., creativity) and other professional ones (e.g., responsive project management), which are generic and related to other fields as well (Redman and Wiek 2021).

Table 2.2. Definition and most common descriptors from the literature for each KC from Redman and Wiek (2021).

Competence	Definition	Descriptors from the literature
Systems-Thinking Competence	Ability to apply modeling and complex analytical approaches: 1) to analyze complex systems and sustainability problems across different domains (environmental, social, economic) and across different scales (local to global), including cascading effects, inertia, feedback loops, and other system dynamics; 2) to analyze the impacts of sustainability action plans (strategies) and interventions (how they change systems and problems).	Understand, identify, describe, analyze sustainability challenges and problems, complex issues, effects, relationships, impacts, patterns, structures, unintended consequences, feedback loops, context, interactions, etc. across different domains (environmental, social, economic), scales (local to global), and perspectives (interdisciplinary), etc. (Connell et al., 2012; Sandri, 2013; Gray, 2018; Levy et al., 2018; Schuler et al., 2018; Mahaffy et al., 2019).
Futures-Thinking Competence	Ability to carry out or construct simulations, forecasts, scenarios, and visions: 1) to anticipate future states and dynamics of complex systems and sustainability problems; 2) to anticipate how sustainability action plans (strategies) might play out in the future (if implemented).	Anticipate, foresight, envision, craft, analyze, and evaluate long-term future consequences, scenarios (multiple futures), and visions regarding intergenerational equity, future generations, uncertainty, etc. (Withycombe, 2010; Gardiner and Rieckmann, 2015; Ojala, 2017).
Values-Thinking Competence	Ability to identify, map, specify, negotiate, and apply sustainability values, principles, and goals: 1) to assess the sustainability of current and/or future states of complex systems; and 2) to construct sustainability visions for these systems; (3) to assess the sustainability of action plans (strategies) and interventions.	Identify, assess, negotiate, reconcile, reflect on, map, apply sustainability principles, morals, norms, ethics, goals, integrity, justice, conflicts, tradeoffs, etc. (Remington-Doucette et al., 2014; Verma et al., 2016; Komasinkski and Ishimura, 2017).
Strategies-Thinking Competence	Ability to construct and test viable strategies (action plans) for interventions, transitions, and transformations toward sustainability.	Design, create, develop, test transformative, innovative, viable, feasible interventions, transitions, strategies, action plans, solutions, etc. considering barriers, inertia, path dependence, carriers, assets, etc. (de Haan, 2006; Wesselink et al., 2015; Fukushima et al., 2017).
Implementation Competence	Ability to put sustainability strategies (action plans) into action, including implementation, adaptation, transfer and scaling, in effective and efficient ways.	Implement, enact, adapt, manage, transfer, scale action plans, strategies, change plans, intervention plans, governance initiatives, etc. (de Haan, 2006; Perez Salgado et al., 2018; Schank and Rieckmann, 2019).
Inter-personal Competence	Ability 1) to collaborate successfully in inter-disciplinary and -professional teams; and 2) to involve diverse stakeholders, in meaningful and effective ways, in advancing sustainability transformations.	Enable, motivate, facilitate interdisciplinary, transdisciplinary, crosscultural collaboration in teams and among stakeholders through listening, compassionate communication, negotiation, conflict

		resolution, empathic leadership, etc.(Ulrich, 2016; Brundiers and Wiek, 2017; Sarpin et al., 2018).
Intra-personal Competence	Ability to avoid personal health challenges and burnout in advancing sustainability transformations through resilience-oriented self-care (awareness and self-regulation).	Reflect, motivate, have respect for, be responsible, be empathetic, selfcare for identity, commitment, feelings, burnout, personal boundaries, limits of capacity, etc (Glasser, 2016; Lozano et al., 2017; Giangrande et al.,2019).
Integration Competence	Ability to apply collective problem-solving procedures to complex sustainability problems: 1) to develop viable sustainability strategies (action plans); and 2) successfully implement them, in collaborative and self-caring ways.	Develop, apply, promote, make decisions to advance sustainability by using viable, equitable, and inclusive solution processes, procedures, frameworks, schemes, etc (Jegstad and Sinnes, 2015; Hull et al., 2016; Wiek et al., 2016).

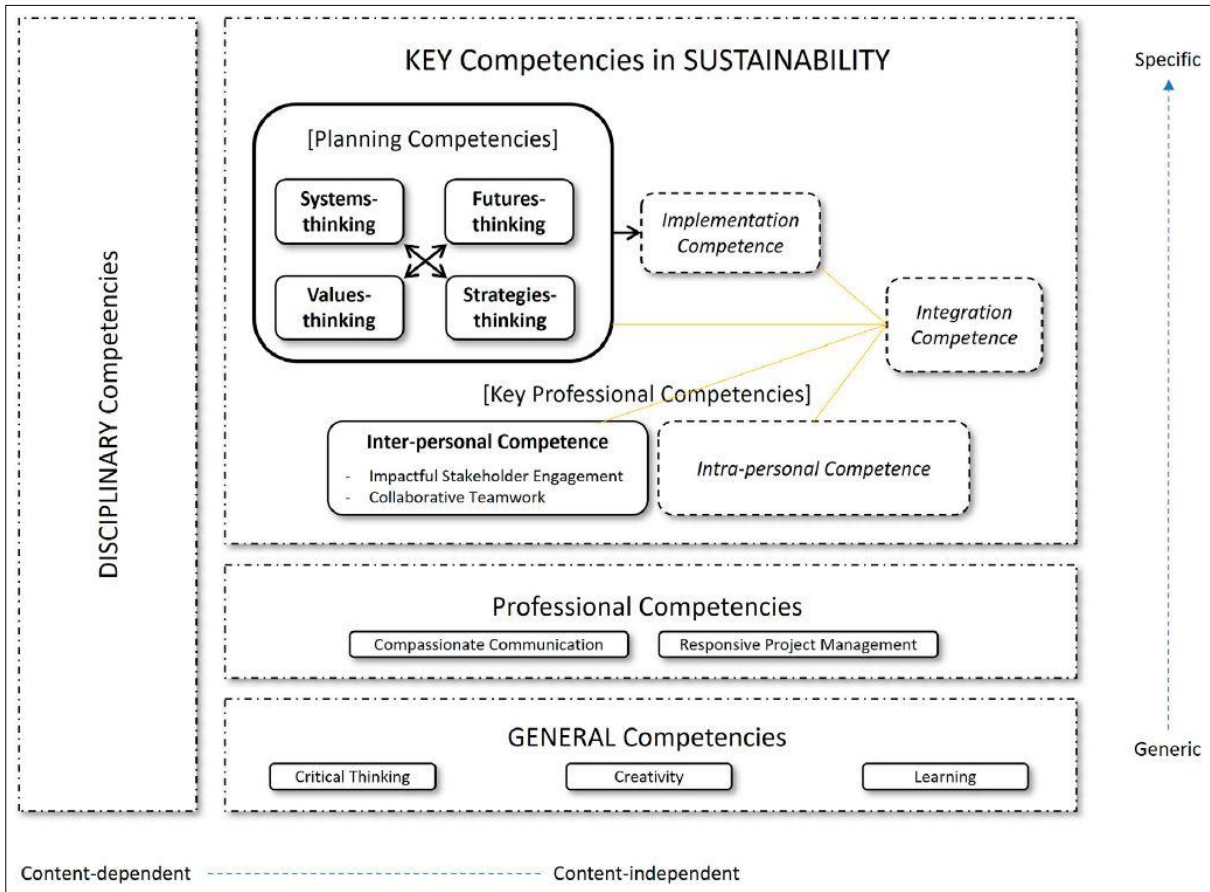


Figure 2.1. UFCAST; centered on 8 KCs with 5 established (bold) and 3 emerging (italic); complemented by disciplinary, general, and other professional competencies. From Redman and Wiek (2021).

3 Methods

3.1 Qualitative Methodology

In this research, a qualitative methodology has been chosen, as it was most suitable for understanding complex social phenomena which both the usage and implementation of the ABCD Process and the UFCAST are. Qualitative methodologies provide contextual, detailed, and rich data that was an advantage for the research because it helped to understand the behavior, subjective motivations, and lived experiences of participants rather than broad data. While the findings are not broadly generalizable across all contexts (Golafshani 2003), this limitation reflects a deliberate trade-off: the choice to prioritize a practitioner-centered, in-depth approach enabled a deep exploration of personal experiences of competency development, insights that are uniquely situated and essential to addressing the study's research questions. Unlike predetermined structures that can be required in quantitative methods, qualitative approaches allowed openness and flexibility to a range of outcomes, including the possibility of no development of KCs at all, which supported a less biased exploration of the ABCD Process. Emergent themes and unforeseen challenges that might have been raised in the learning process were allowed to impact the research (Naeem et al. 2023). Furthermore, qualitative methodology supported working in the value-laden and complex contexts of sustainability (Nagatsu et al. 2020). Additionally, given the short time frame and limited access to practitioners, qualitative methods were also the more feasible choice. Pre-existing quantitative datasets, while potentially easier to analyze quickly, would not have captured the depth, context, and personal meaning necessary to understand how individuals perceive and experience the development of KCs through the ABCD Process.

3.2 Research Design

The conducted research included two phases: Phase 1 provided an in-depth analysis of the current academic discourse regarding the development of KCs through the ABCD Process, identifying connections and discrepancies that answer the research question. This phase included a conceptual mapping using academic literature as well as interviews with experts. Phase 2 explored the development of KCs in the ABCD Process through practitioner interviews, aiming at understanding the current professional practice. Both phases were designed with the opportunity in mind to open a creative tension between academic intentions and experienced practice, bringing transparency and detail in answering our research question. In the research, the methods of conceptual mapping of academic literature, expert interviews, and practitioner interviews were employed to strengthen the methodological coherence by integrating diverse data sources.

3.3 Phase 1: Analysis of Current Academic Discourse

3.3.1 Preparatory Conceptual Mapping using Academic Literature

The first step involved preparatory work in the form of a qualitative review of academic literature, which informed a first conceptual mapping of the ABCD Process against the KCs. By reviewing relevant articles, papers, and sources related to the FSSD and the UFCAST, the research team developed foundational knowledge of both frameworks. This groundwork

supported the development of the preparatory conceptual map, which was then used to guide and inform the expert interviews. A systematic search strategy was employed to identify a relevant pool of academic sources. This involved developing targeted search strings for Scopus, followed by the screening and review of all retrieved articles to ensure alignment with the research focus. Scopus was chosen as it is one of the largest multidisciplinary science databases of peer-reviewed scientific papers, journals, and books (Baas et al. 2020). For each review, a search term was defined, followed by a systematic two-stage screening process. The initial stage involved screening titles to determine their relevance to the research question, while the subsequent stage entailed a detailed examination of abstracts and keywords to ensure alignment with both the research objectives and the core frameworks underpinning the study. The search was conducted on February 20, 2025. Search terms are shown in Appendix A. This query brought, after screening, 40 highly relevant results for the ABCD Process (from 108 search results) and 42 for the UFCAST (from 498 search results).

After the data collection and thoroughly perusing all selected articles, the research team conducted a conceptual mapping between the two frameworks to create a structured and organized visual representation of our understanding of the connections and non-alignments based on the relevant literature. The preparatory conceptual mapping was held with all research team members using the online software tool Miro to create a matrix that mapped the interconnections, or lack thereof, between each individual step within the ABCD Process, and the ABCD as an overall process, with the eight individual KCs. Every team member filled the matrix with their reflection based on the accrued data from the literature review. The results were then discussed, reviewed, and edited by all four members of the research team to reach a final consensus, that has been agreed by all four team members, between the ABCD Process and the UFCAST. This preparatory conceptual mapping is shown in Appendix B. This mapping not only synthesized initial findings but also acted as a foundational tool in preparation for the expert interviews, as it enabled us to present our information in a structured, accessible way in which feedback could be easily included.

3.3.2 Interviews with Experts

This section details the method of conducting interviews with experts to validate and refine our understanding of the connections between the ABCD Process and the UFCAST. The process was built on the conceptual mapping described above, followed by interviews to provide theoretical insights and triangulation for the broader research. The interviews were deliberately framed around conceptual expertise rather than practical experience to focus on theoretical validation.

Preparation and Selection of Experts

Semi-structured interviews were conducted, which provided a balance between comparability of data and flexibility, allowing the research team to capture expected results while remaining open to exploring unexpected insights (Adams 2015). This approach offered greater flexibility compared to structured interviews, while still maintaining a level of comparability, though it required a higher level of rigor in coding and analysis. The results can lead to more rich, contextualized, and personalized experiences being shared, which is critical for understanding the nuanced development of KCs. We chose this method over alternatives such as surveys with open-ended questions, which would have deprived us of the opportunity to interact with interviewees and explore their experiences in depth (Gill et al. 2008).

Two interviews were conducted with leading experts in the fields of the FSSD and the UFCAST. The first interview was with Expert 1 (E1), a leading scholar in sustainability education, who has played a key role in conceptualizing and advancing the UFCAST. They were contacted via an introductory email sent by the research team's primary advisor, as it was suggested that a request from someone previously acquainted with E1 through academic discourse would increase the likelihood of a positive response. The second interview was with Expert 2 (E2), who is internationally recognized for their foundational work in developing the FSSD, including the ABCD Process. They were contacted directly via email by the research team, as connections existed before due to E2's role in the research's corresponding department. Each interviewee was selected based on their direct involvement as conceptual founders of their respective frameworks. This helped to ensure theoretical validation and refining of the preparatory conceptual mapping through insights into the theoretical underpinnings of both frameworks.

Interview Structure and Flow

Despite the difference in the focused framework, both interviews followed mirrored semi-structured formats with the intention of enabling comparative analysis. The semi-structured interview flow can be found in Appendix C.

Both expert interviews were conducted via the Microsoft Teams platform provided by Blekinge Institute of Technology, which offered a reliable and secure digital environment conducive to high-quality audio-visual interaction, facilitated real-time screen sharing for collaborative engagement with the conceptual mapping, and enabled automatic recording for accurate transcription and post-interview analysis. For both interviews, there was one lead interviewer and one second interviewer, with the two other research team members taking notes throughout the interview process. The first interviewer led the opening framing and key competency application questions while the second interviewer went through and led the framework mapping section. The second interviewer also took the expert through the preparatory conceptual mapping, via Miro, and updated a copied version of the preparatory conceptual mapping to include feedback from the expert. Following the interview, the second interviewer cleaned the transcript.

To ensure that both interviews were prepared for the interview and could engage with our conceptual framing, a set of standardized preparatory materials was provided in advance, including the research question, definitions of the ABCD Process and the KCs, relevant foundational papers [E1 received (Broman and Robèrt 2017); E2 received (Redman and Wiek 2021)], our preparatory conceptual mapping of the KCs against the ABCD framework, a full list of the interview questions and flow, and the General Data Protection Regulation (GDPR) Consent Form.

Data Analysis

For data analysis, deductive coding was done by the same two team members for both interviews. The deductive themes used for coding were directly derived from the two conceptual frameworks: the UFCAST and the ABCD Process. The following themes were applied: "Systems Thinking", "Futures Thinking", "Values Thinking", "Strategies Thinking", "Implementation Competency", "Interpersonal Competency", "Intra-personal Competency", "Integration Competency", "All Competencies"; and on the other axis "A-Step", "B-Step", "C-Step", "D-Step", "Whole ABCD Process", "Other Reflections". This data was coded in two

ways: on the one hand, in a matrix including the connection of an ABCD Process step with a certain KC. On the other hand, a general sheet captured data that was not connected, to capture further insights and reflections. The data that was coded by both team members was then culminated into a coding master file to ensure greater visibility and organization.

Data Visualization

To visualize and interpret the relationships between the expert's understanding of the two frameworks, a heatmap was developed (Table 4.1). To ensure reasoning and further detail for the heatmap, the research team used quotes and discussion from the expert interviews, or lack thereof, for every cell in the heatmap. Along with the mapping, quotes and insights from the expert interviews were used to provide additional depth and verification of the updated conceptual mapping and understanding of the interconnection and emergent themes between the ABCD Process and the UFCAST.

The construction of the heatmap began with an independent review of both expert interviews from two team members to track KC-ABCD linkages. The linkages between individual KCs and ABCD Process steps or the ABCD Process, as a whole, were culminated systematically in a coding master file for expert interview data. Any discrepancies or differing opinions and counts were discussed and resolved collaboratively to ensure reliability and reduce individual bias. The resulting data provided a direct examination of the two experts' beliefs which was then used to inform the heatmap. The heatmap visualizes the level of alignment based on consensus or lack thereof between experts on the linkages between KCs and ABCD Process steps and the whole process ("ABCD Process"). The color scale was split into three tiers to enable distinct differences for interpretation. The lowest tier (white) cells are based on linkages where both experts agreed that there was a non-alignment, or where there was no relevant discussion toward the linkage from either expert. The middle tier (gray) cells are based on linkages where one expert agreed there was alignment, yet the other expert disagreed or did not contribute any relevant discussion to the linkage. The highest tier (black) cells are based on linkages where both experts agreed on the alignment.

The heatmap was chosen as a method to visualize the results of the expert interviews for two main reasons. Firstly, it followed a similar structure to the preparatory conceptual mapping based on academic literature. This preparatory conceptual map guided the structure of the interviews and, as a result, influenced the use of heatmaps as a method for visualizing the data derived from them. Secondly, the heatmaps enabled organized and structured comparisons. Although the different result phases produced slightly varied heatmaps that do not mirror each other exactly, they remain comparable as both were developed with a focus on qualitative value (more detail on Phase 2 can be found in section 3.4.1). With additional nuance and detail from quotes and discussions within these interviews, the heatmaps act as an overview to assist in the guiding discussions and as an answer to the research question.

3.4 Phase 2: Analysis of Current Professional Practice

3.4.1 Interviews with Practitioners

Preparation and Selection of Practitioners

The method for the analysis of current professional practice was interviews with ABCD practitioners. The primary purpose of these interviews was to capture lived experiences, focusing on how practitioners develop KCs through their work with the ABCD Process. Interviews are known to be insightful and targeted, as they access the feelings, experiences, and opinions of individuals and are suitable for collecting people's lived experiences and individuals' actions, which is essential for our qualitative research focusing on the details and complexity of such an implementation process in sustainability. Fourteen interviews with practitioners who use the ABCD Process in their work were conducted, ensuring that the results are grounded in real-world experiences that are relevant to our target audience of practitioners and educators. Practitioners were recruited from existing MSLS networks and connections. This population was chosen based on convenience as contact details were available through MSLS' faculty and team members' network and this group was highly responsive.

Semi-structured interviews were carried out for practitioner interviews. The reasoning behind choosing semi-structured interviews was similar to the reasoning described in Section 3.3.2.

To assess the qualifications of potential interviewees and to be able to include or exclude practitioners based on criteria while maintaining flexibility, a preliminary survey was developed and circulated among the MSLS network. The survey included questions on how the practitioners first learned about the ABCD Process, the country where they have mostly worked, the number of years incorporating the ABCD Process into their work, the sectors where they have applied it, and the typical process of application.

The demographic breakdown of the fourteen interviewees represents a range of professional backgrounds, including business, non-profit, public sector, and academia, ensuring a breadth of perspectives on the application of the ABCD Process. Geographically, the sample spans multiple countries-primarily Sweden, but also France, Vietnam, Germany, Argentina, and some practitioners operating across various locations as freelancers, further reflecting the international scope of the study. In terms of experience, interviewees vary from those with less than three years to over twenty years of incorporating the ABCD Process into their work. Additionally, how participants were first introduced to the ABCD Process is varied, encompassing formal education, professional settings, peer networks, and independent study. This diversity allows for a more comprehensive understanding of how the ABCD Process is perceived and implemented across different contexts and sectors. Based on the resulting survey answers from the fourteen respondents, the research team found all to be fit for interviews. The demographic split of the interviewees can be found in the Appendix D.

Although the initial interview pool comprised fourteen participants, only the data from thirteen participants was included in the final analysis. While all fourteen individuals completed interviews, the data from one respondent (P7) was excluded upon further review, as their responses did not demonstrate practical application of the ABCD Process. This respondent therefore did not meet the predefined criterion for inclusion as an ABCD practitioner, which required evidence of direct engagement with the ABCD Process. Excluding this data ensured

that the analysis was based solely on interviews reflecting relevant, first-hand experience with the ABCD Process, thereby maintaining the integrity, validity, and focus of the research.

Interview Structure and Flow

Before each session, interviewees received a summary of the research question and key definitions of the ABCD Process and the eight KCs, as well as a GDPR consent form. At the beginning of each interview, participants were reminded of their rights under GDPR, including consent to record and the option to withdraw or redact any part of the conversation. Each interview followed a semi-structured flow to ensure comprehensive data collection while allowing for narrative depth and analysis. The flow is shown in Appendix E.

All practitioner interviews were conducted via the Microsoft Teams platform provided by Blekinge Institute of Technology, the reasoning as to why Microsoft Teams was selected as the virtual platform for the interviews can be found in Section 3.3.2. Each interview involved a rotation of three different research team members to enhance data richness and minimize interviewer bias. Particularly, there was a lead interviewer, a second interviewer, and a coder present in every interview. The lead interviewer guided the conversation according to the aforementioned flow. The second interviewer supported the interview by providing clarifying questions, managing time, and acting as a mediator between the coder and lead interviewer. The coder identified references to specific KCs in real-time. For coding, there were two tables the coder would use to reference mentions of KCs during the interview. The first table consisted of each KC within a separate row and keywords or phrases in columns (see Appendix F). The coder would highlight in green the specific keyword / phrase and KC when they found it referenced in an interview. The second table held a matrix of each KC on one axis and each step of the ABCD Process along with another column for the ABCD Process, as a whole, and Time Development on the other axis (see Appendix F). The coder would mark in a specific box on this matrix a timestamp where they felt relevant references were made during the interview.

After the interview, the second interviewer cleaned the transcript for grammatical and transcription errors while the coder and the fourth team member – who did not participate in the interview – would carry out the data analysis, ensuring another pair of eyes came in with fresh perspective and less bias. The process of this is detailed in the next section.

Data Analysis

To ensure a comprehensive analysis of the data gathered from the interviews, a dual approach was employed that combined deductive coding and inductive clustering. First, deductive coding was done, based on the UFCAST and the ABCD Process steps, aligning with existing knowledge for theoretical consistency. To identify emergent themes and unexpected insights from practitioners' narratives, inductive clustering followed the coding. This mixed approach allowed flexibility to capture new findings while maintaining a structured foundation (Maxwell 2012), addressing the complexity of sustainability phenomena.

Deductive coding was done by all team members for an equal number of interviews, ensuring that every interview was coded by two people. In an introductory workshop, all team members came together to align a coding procedure. Additionally, a codebook was developed and shared between team members, to enhance efficiency and the rigor of the analysis across team members while maintaining transparency and consistency. The deductive themes and codes applied were the same as those described above (see section 3.3.2), covering both the KCs and the ABCD Process steps. This data was coded in two ways: (1) in a matrix including the

connection of an ABCD Process step with a certain KC, and (2) in a general sheet that captured data that was not connected, to show further insights and reflections. All data was later combined in one coding master file with possibilities to filter and sort between KCs, ensuring an efficient inductive coding procedure.

The inductive coding of the practitioner interviews was done by three team members of the team, in which every person coded two-thirds of the data, ensuring that each insight was coded by two people. In detail, all information about a certain KC or step was combined and summarized into sub-themes and interesting quotes, that were directly used as a foundation for writing the results and discussion section. The writing document was revised iteratively with the coding master file.

Data Visualization

To systematically visualize and interpret the relationships between KCs and the steps of the ABCD Process, a heatmap was developed (see Table 4.2). This heatmap served as a central analytical tool, linking the deductive coding and iterative thematic analysis to a clear, accessible representation of how practitioners perceive the interplay between competencies and process phases.

The construction of the heatmap followed a two-step procedure. Step 1 contains the quantification of KC-ABCD linkages. Each interview was independently reviewed by two team members, who systematically recorded each instance where a KC was associated with a specific step of the ABCD Process (A, B, C, D) or with the ABCD Process, as a whole, by the practitioners. Any discrepancies in these counts were discussed and resolved collaboratively to ensure inter-coder reliability. The resulting participant – level counts rather than raw quote frequencies – formed the basis of the heatmap matrix. For analysis, the data was grouped as follows: the heatmap displays the number of participants who linked each KC to individual ABCD steps or to the whole process (“ABCD Process”). Additionally, it includes categories for cases of non-alignment, describing a KC that was discussed but not clearly associated with any specific step or the whole process, as well as “Top KC” mentions, indicating KCs that were identified by participants as having particularly high relevance (most important, most obvious, and / or most needed in the ABCD Process). This approach captures how an individual perceives the relationship between competencies and process steps, rather than simply tallying the number of times a concept was mentioned.

Step 2 contained the extraction of patterns and themes. Building on the coded data, at least three team members conducted several iterative rounds of analysis to extract overarching patterns and emergent themes. This process enabled us to move beyond simple frequency counts to identify deeper qualitative insights, which are reported in the results and discussion sections.

The heatmap visualizes the count of individual participants (n=13) who identified specific linkages between KCs and ABCD steps (A, B, C, D, and ABCD Process), rather than quote frequency, with attributions made only when participants explicitly or implicitly associated competencies with particular phases; the color scale and the palette were tested for accessibility, including deuteranopic visibility (80% severity). The scale was stratified into four tiers: 0-2 (lightest, 0-14% of cases, below critical mass for pattern recognition), 3-5 (medium-light, 21-36%, meeting threshold for recurring themes (Guest et al. 2006)), 6-8 (medium, 50-64%, reflecting substantial participant agreement), and 9+ (darkest, 79%, indicating consensus-level alignment (Hill et al. 2005)).

3.5 Research Quality and Ethical Consideration

To maintain the integrity of the study, measures to support research quality were incorporated. These steps are consistent with the framework proposed by Korstjens and Moser (2018), which outlines quality criteria tailored for early-career researchers, such as those pursuing a Master's degree. The framework emphasizes evaluating credibility, transferability, dependability, confirmability, and reflexivity.

To ensure the credibility of the findings, defined as the accuracy and validity of the research outcomes, multiple methods were conducted. Triangulation was employed reiteratively by integrating multiple data sources: academic literature, interviews with experts (n=2), and interviews with practitioners (n=13). This multi-method approach allowed for cross-verification of the interconnections between the ABCD Process and KCs, enhancing the robustness of the findings. Additionally, the conceptual mapping, initially developed from literature and validated with expert interviews against the experiences of practitioners enhanced theoretical credibility. Member checking was employed by sharing preliminary findings with selected interviewees, who confirmed the interpretations' alignment with their perspectives. The involvement of multiple researchers in coding and analysis further bolstered credibility through inter-coder agreement, reducing the risk of individual bias in interpreting qualitative data (Birt et al. 2016).

Transferability, the extent to which findings can be applied to other contexts, was addressed by providing rich, contextual descriptions rather than aiming for broad generalizability. This approach is exemplified by the research's exploration of diverse applications of the ABCD Process across practitioners varied professional backgrounds (e.g., business, non-profit, public sector, and academia) and the wide range of sustainability challenges they addressed, allowing readers to evaluate the relevance of the findings to their settings. However, although the basic construction of the ABCD Process can be assimilated into other strategic planning processes based on steps like backcasting, the results of this research cannot and should not be applied in any other contexts. The population of interviewees and experts led to a set of results that can only be equated to the relationship directly between the ABCD Process and the UFGAST.

Dependability, or the consistency of the research process, was ensured through a comprehensive audit trail documenting all methodological steps. This included detailed records of the literature search strategy (e.g., Scopus queries), interview protocols (semi-structured guides for experts and practitioners), coding schemes (deductive and inductive approaches), and decision-making processes (e.g., team consensus on conceptual mapping and heatmaps). The semi-structured interview format was consistently applied, with standardized questions and follow-up prompts to maintain procedural consistency. Potential biases, such as confirmation bias due to the research team's familiarity with the ABCD Process from the MSLS program, were mitigated by designing neutral, open-ended interview questions and conducting regular team discussions to critically reflect on assumptions. Cross-checking and cross-referencing results among team members further enhanced the reliability of the analysis.

Confirmability, the degree to which findings reflect the data rather than researcher bias, was prioritized through transparent and data-driven analysis. A detailed codebook, developed and shared among team members, ensured consistency in coding across interviews and the conceptual mapping exercise. Multiple coders reviewed each interview transcript, resolving discrepancies collaboratively to minimize subjective influence (Patton 2015). While time constraints and varying interviewee understanding occasionally limited the depth of discussion

on certain KCs (e.g., Integration Competency), these instances were documented and factored into the analysis. The research team's shared MSLS background was recognized as a potential source of bias, countered by triangulation with external expert interviews and systematic cross-checking of interpretations.

Reflexivity involves acknowledging the researchers' roles and assumptions and their potential influence on the study. As graduates of the MSLS program, where the ABCD Process is a core component, the researchers recognize their familiarity with the framework as both an asset and a liability. This background facilitated nuanced questioning during interviews and informed the conceptual mapping, yet it risked confirmation bias, potentially overemphasizing connections between the ABCD Process and the KCs. To address this, researchers engaged in reflexive team discussions, questioning their interpretations and designing interview prompts to elicit critical perspectives (e.g., asking practitioners about ABCD limitations). That the interviewees, often connected to the MSLS network, might share similar biases or emotional attachments to the ABCD Process, was considered as well.

The study adhered to rigorous ethical standards to safeguard participants' rights and privacy. Informed consent was obtained from all interviewees (experts and practitioners) before participation, with clear explanations of the study's purpose, procedures, and their rights under the GDPR, including the right to withdraw or request data redaction. Confidentiality was upheld by anonymizing transcripts and using pseudonyms in reporting findings. Data was stored securely on password-protected systems, in compliance with Blekinge Institute of Technology's institutional policies and GDPR requirements. As the research did not involve the collection of sensitive personal data or vulnerable populations, no major ethical concerns were identified.

4 Results

This chapter is structured to reflect both the iterative nature of the research and the need for clarity in presenting the complex interconnections between the ABCD Process and the UFCAST. Findings from the research process are organized in two sections. The first section summarizes the key insights from the interviews with experts. The second section shows findings from the interviews with practitioners. This progression from theoretical grounding to practical application mirrors a general-to-specific flow, first examining competency development across the ABCD Process, as a whole, before analyzing step-by-step alignments. Both phases employ heatmaps as integrative visual tools. Phase 1’s heatmap (Table 4.1) captures expert insights on theoretical alignment, using a grey-scale to illustrate connection strength. Phase 2’s heatmap (Table 4.2) shifts focus to practitioner attributions, quantifying how often participants linked competencies to specific ABCD steps or the process holistically. Though structurally parallel (e.g., shared greyscale and layout), the heatmaps serve different purposes: one reflects theory-informed categorization shaped by expert perspectives, while the other captures patterns grounded in real-life application through practitioner experiences. While the UFCAST and each KC are meant to be seen as an interconnected whole, for practical reasons, a linear structure of presenting the KCs is followed in the writing, based on the order in the framework (Redman and Wiek 2021).

4.1 Results from Phase 1: Interviews with Experts

The following sections contain the results of the expert interviews, summarized in the conceptual heatmap below, as well as go into depth on the reasoning and foundation of the expert’s opinions on the alignment or non-alignment between the two frameworks.

Table 4.1. Expert-informed conceptual heatmap. For details & legend see section 3.3.2.

	Systems Thinking (KC1)	Futures Thinking (KC2)	Values Thinking (KC3)	Strategies Thinking (KC4)	Implementation (KC5)	Inter-personal (KC6)	Intra-personal (KC7)	Integration (KC8)
ABCD Process	Black	White	Black	Black	White	Black	Black	Black
A-Step	Black	Black	Black	Grey	White	Grey	Black	Grey
B-Step	Grey	Grey	Black	Grey	White	White	White	Grey
C-Step	Grey	Black	Grey	Grey	White	White	White	White
D-Step	Black	Grey	Black	Black	White	White	White	White

Table 4.1 represents the conceptual mapping of alignment or non-alignment between the ABCD Process and the UFCAST, incorporating experts’ knowledge and opinions. Through the color-gradient coding, the level of connectivity between the frameworks is visualized, as described in section 3.3.2. The results below provide more depth into the reasoning from experts’ perspectives as to the connection or lack thereof between the two frameworks, exploring each cell within the matrix and the corresponding data.

4.1.1 Systems Thinking (KC1)

For KC1, both experts agreed on the importance and foundation of the competency across the ABCD Process. E2 stated that *“The FSSD promotes a systemic perspective. Because to be successful, we need to have a systems view. We cannot solve one issue at a time”*. The SPs which are embedded in the ABCD Process are even specifically created based on KC1, according to E2. E1 explored more as to why this KC is critical in the ABCD Process and how it lends to being able to understand and point out leverage points within systems, *“Systems Thinking competency obviously underpins strategy development. [...] Values Thinking guides it, Systems Thinking underpins it [...] because you want to [...] identify, where would I intervene in my complex problem situation to have the highest leverage of change”*.

For the A-Step, both experts agreed that visioning activities support KC1 by encouraging the recognition of system complexity and interrelations. E1 emphasized that *“You need to have Systems Thinking competency because our future is [...] systemically interrelated. [...] It remains a complex adaptive system between social and ecological systems that we are in. So you need that to also then develop your vision”*. E2 also stressed the importance of KC1 in modelling sustainable futures: *“The vision needs to be covering various aspects, not only be one aspect, and modelling those aspects within Sustainability Principles is complex and requires Systems Thinking”*. E2’s reference to the SPs highlights how applying them in visioning helps reveal system interconnections.

In the B-Step, only E1 provided step-specific input on the connection between this step and KC1 when saying *“Foundational for current state analysis is Systems Thinking”*. There was no further context provided from this quote or other information on how this step specifically can facilitate the development of KC1.

In the C-Step, E2 emphasized that KC1 is essential during solution brainstorming to avoid unintended consequences: *“Systems Thinking is there because when we try to create the solutions to close the gap, we need to have Systems Thinking. Otherwise, we will come up with solutions for a specific problem and likely create other problems”*. E1 did not provide any comments on whether the C-Step facilitated, or didn’t facilitate, the development of KC1.

In the D-Step, both experts noted KC1’s role in identifying high-leverage interventions. E1 highlighted that *“Systems Thinking underpins the development of strategies, because it helps us to understand where to intervene in the system, and because we understand how the system works, we understand also how intervention theory [...] would ripple through in order to generate the intended results”*. E2 emphasized that KC1 helps avoid poor prioritization: *“Systems Thinking is there since when we prioritize measures, we need to consider a systems perspective. We cannot be narrow minded, because then we will make a bad prioritization”*.

4.1.2 Futures Thinking (KC2)

There was no discussion from either expert on how the overall ABCD Process was aligned or non-aligned to KC2, rather individual attributions, and discussions through specific steps within the ABCD Process.

In the A-Step, both experts agreed that visioning clearly fosters KC2. E1 stated, *“In doing [the] visioning activity, obviously [...] you need Futures Thinking competencies because it’s a vision”*. Similarly, E2 noted, *“Futures Thinking is obviously needed since we are visioning the*

future and look at where we are at in relation to that future". E2 also explained that using the SPs frames visions within viable future constraints: *"The FSSD is open for any description of success as long as it is within the SPs. It does not exclude anything above the SPs, but the SPs need to be complied with. Otherwise, the vision cannot exist in the future"*.

Only E2 noted an alignment between the B-Step and KC2 stating, *"You don't look at the current situation and all the things you have in [an] isolated way. You do the analysis in relation to the vision and the SPs framing the vision"*. E2's comments underscore the role of KC2 in framing the baseline assessment. E1 provided no discussion regarding any alignments or non-alignments within this step towards KC2.

Both experts agreed that KC2 is present in the C-Step, as it involves planning future actions. E2 noted, *"Futures Thinking, obviously, because we think about steps that will happen in the future"*. E1 expanded on the role of creativity and imagination within KC2: *"The key competency of Futures Thinking entails competencies including creativity, because you enable yourself to think how the [...] future can be different from the past or present [...]. In C [Step] is definitely the combination of Futures Thinking and Strategies Thinking"*.

E2 stated that KC2 is developed in the D-Step due to the need to prioritize actions with a future-oriented lens: *"Futures Thinking is there since we are thinking about what are the smartest things to do going forward. We are stretching into the future"*. The other expert had no input on the alignment, or non-alignment, between KC2 and the D-Step.

4.1.3 Values Thinking (KC3)

E1 emphasized that KC3 frames the entire ABCD Process, *"because often you know you need especially the Values Thinking competencies. That obviously frames every step"*. E2 explained that the SPs are designed to remain values-neutral, creating space for values to be explicitly added later: *"The SPs we have tried to make as little dependent on values as possible. Not because values are bad, but because we want to have a foundation that is as values-free as possible, on which values could and should be added when specific actions are to be decided upon"*.

Both experts agreed that KC3 is developed in the A-Step through the visioning process. E1 noted, *"And then obviously there's Values Thinking involved, because visioning [...] is a normative activity. [...] The vision is always a normative construct of the future"*. E2 added a similar sentiment, *"It is very important to bring in values when co-creating the vision. The vision should be within the SPs as a frame, but within that it is completely open and values should come in when more specific descriptions are done to a level of detail that the participants can agree upon"*.

Both experts agreed that KC3 is present in the B-Step due to its connection to value-driven visioning and the role of values in assessing current reality. E1 explained, *"When you move into the assessment, that's where the Values Thinking comes in because you have to identify what values are being used for the assessment. [...] So it's important to recognize if there is a discrepancy or positive synergy between the values that guide a company and the values that are inherent in the definition of sustainability"*. E1 also noted that KC3 comes into play when evaluating what a current reality assessment means in a more holistic perspective. E2 added, *"Since values are involved in the creation of the vision, and since in the B-Step we do the analysis in relation to the vision, we need to relate to the values that are in the vision or that"*

have influenced and shaped the vision. Values are also part of the reality in the current situation”.

One expert claimed that KC3 is present and guiding in the C-Step: *“Values are always there. They will always influence the ideas that we come up with, and they should”.* E1 did not contribute to any discussion about the alignment or non-alignment between the C-Step and KC3.

Both experts spoke about the development of KC3 in the D-Step. E1 noted its role in shaping strategies that reflect sustainability values, *“we also use Values Thinking competency because [...] the means to the end are [...] representative of the sustainability values that the end should also generate. That’s why Values Thinking comes [...] in guiding the strategy development”.* E2 emphasized values as a basis for prioritizing actions, *“We have many possible visions within the SPs and we have many possible routes to take from the current situation to that vision. What route to prioritize depends also on our values. Some people prefer to take one route [...] and other people prefer another route [...]. Then we have discussions and agree on something”.*

4.1.4 Strategies Thinking (KC4)

Before providing results, it is important to note that experts used the terms Strategies Thinking and Strategic Thinking interchangeably. The results are therefore presented using both as an indicator for KC4 (see section 5.1.4 for detailed elaboration).

Both experts agreed that KC4 is closely aligned with the ABCD Process. E2 noted, *“[Strategies Thinking] is an obvious match, since the goal [...] is to create a strategic plan and to iterate that and refine and recreate it”.* E1 explained that strategy enables transformation: *“Strategy helps us [to] move from the current state, to transform the current state and work towards a vision,”* and added, *“You can enhance in focusing on one thing, developing a strategy using competencies from the key competencies of strategy, Strategic Thinking”.*

E2 stated that KC4 is developed in the A-Step, as visioning is foundational to strategy: *“To be strategic, we need to have a vision that is inherent to the concept itself. To be able to be strategic, we need to know where to go. So, the A-Step is crucial for the possibility to be strategic”.* In contrast, E1 saw visioning as a precursor rather than a component of Strategic Thinking: *“The strategy can only be developed when you know [...] your vision, and you [...] backcast from there to the current state, but you don’t also know the current state. You always need to know these two reference points, [...] so Strategic Thinking competency is not involved in the visioning, it follows from the visioning”.*

E2 stated that KC4 is developed in the B-Step, as knowing the current state is essential for strategy: *“To be able to create a strategic plan, you need to know both where you want to go and you need to know where you are. [...] Because the purpose of the strategic plan, the actions included there, is to close the gap between where you are and where you want to be, and you need to know both where you want to be and where you are”.* E1 did not contribute or discuss any alignments or non-alignments between this competency and the B-Step.

Both experts saw a limited or indirect alignment between KC4 and the C-Step. E1 described it as, *“Because you’re thinking ideas for strategy, [...] you activate Strategic Thinking competency [...] and that’s [...] the very simple and maybe abbreviated version of Strategic Thinking”.* E2 shared a similar view, noting, *“it depends on how strictly you define Strategic*

Thinking [...] in the C-Step,” but added, “Strategic Thinking will influence the creation of measures, since the whole idea [...] is to close the gap between present and [...] future in a strategic way”.

Both experts emphasized a strong alignment between KC4 and the D-Step. E1 described it as the “primary competency” in developing and prioritizing strategies: *“Strategic Thinking obviously comes in because we want to do strategies [...] that [...] don’t just generate sustainability [...] results, but that they do this with sustainable resources, means that we use Strategic Thinking competency”.* E2 confirmed, *“in the D-Step, there is obviously a strong alignment with Strategic Thinking”.*

4.1.5 Implementation Competency (KC5)

Both experts acknowledged that KC5 is not explicitly developed through the ABCD Process. E1 emphasized learning about KC5 indirectly, *“I still learn about implementation because I observe people doing that”*, while also noting a separation between strategy development and practical execution. E2 highlighted the importance of iterative implementation, *“A plan is created, it is started to be implemented and then it needs to be adjusted iteratively”.* However, neither expert identified a direct connection between KC5 and the ABCD Process, as a whole.

Both experts shared that KC5 is not developed or connected to the A-Step. E1 shared, *“So the Implementation Competency obviously [is] not involved in visioning activities”.* E2 stated, *“If we have a strict definition of the A-Step and a strict definition of implementation, then this box should be empty [referring to the conceptual map]”.*

Neither expert contributed or discussed the alignment or non-alignment of KC5 and its development to the B-, C-, or D-Steps, respectively.

4.1.6 Interpersonal Competency (KC6)

Both experts agreed that KC6 is developed throughout the ABCD Process due to its inherently collaborative nature. E1 noted, *“Going through the steps is done always in a team because we need to bring in diverse perspectives [...]. It’s a collective endeavor,”* and emphasized the role of both interpersonal and intra-personal dimensions: *“If it’s a collective process, and if you feel personally challenges and you want to give your best to Inter- and Intra-personal Competency, the collaborative and the self-competency [is] involved as well”.* E2 echoed this, stating, *“Since we have many competencies and many stakeholders, we need to have these collaborative processes going on”*, and emphasizing that, *“it should be a collaborative work in all the steps”.* E1 also noted the importance of engagement, *“it is completely worthless if we cannot engage people [...]. So, we need a leadership component too. We need to learn [...] how to bring in people into the collaborative work”.*

E1 shared that KC6 is developed in the visioning activity because it is carried out in a collective setting: *“And then if the vision is done in [...] a collective setting, then obviously you need to have collaborative competency”.* No further contributions from E1 were made and E2 had no contributions to the alignment or non-alignment between KC6 and the A-Step.

Neither expert contributed or discussed any alignment or non-alignment between KC6 and the B-, C-, and D-Steps, respectively.

4.1.7 Intra-personal Competency (KC7)

Both experts emphasized the importance of KC7 throughout the ABCD Process, particularly in supporting effective collaboration. E1 noted, *“In order to show up well in a collective team, you always need to take [care] of yourself. [...] People had to practice building up their own resilience and well-being”*. E2 shared similar sentiments, *“broken, burnt-out people cannot save the world. We need to take [...] care of ourselves to be able to help others, and to help society, so this is absolutely critical”*. E2 also linked KC7 to the SPs: *“The Sustainability Principles also guide us to think about structural obstacles to health, competence, [...] that are also related to intrapersonal competence”*. However, E2 clarified that KC7 is needed in the application of the ABCD Process and is neither explicitly included nor excluded from the process.

Both experts noted that KC7 is relevant in the A-Step due to its collective and reflective nature. E1 stated, *“And then if the vision is done in an [...] collective setting, then obviously you need to have collaborative competency, and Intra-personal Competency as well. [...] You know you have these two competencies [Inter- and Intra-personal] [...] across the whole process, because they are needed in A-Step’*. E2 linked the visioning process to well-being within the SPs: *“In the future vision you obviously want people to be healthy and be able to take care of themselves in doing whatever work they are doing”*.

Neither expert contributed or discussed any alignments or non-alignments between KC7 and its development in the B-, C-, or D-Step, respectively.

4.1.8 Integration Competency (KC8)

E1 described KC8 as a background competency developed across the ABCD Process, supporting integrated sustainability problem solving: *“You selected the ABCD framework, [...] I would say I wouldn't include it [Integration Competency] right now, but obviously it is the background within which problem solving occurs, and the understanding of the key competency occurs, because they support all steps in sustainability problem solving”*. E1 added, *“all of this is the integrated problem-solving competency. [...] In the ABCD Framework, [...] strategy helps us to move from the current state, to transform the current state and work towards a vision, knowing that we are doing this in the complex, highly adaptive world”*. E2 also supported its relevance, emphasizing iteration and interconnection: *“The ABCD is not a linear process [...]. There is a general motion [...] but you have flashes of thoughts of all those steps all the time. [...] You also iterate the whole procedure over and over again”*.

E1 shared that KC8 is not involved in the A-Step and the visioning activity. E2 differed in their opinion, expressing that the A-Step is a transdisciplinary exercise that encourages participants to learn to integrate among different stakeholders and conditions: *“You integrate different disciplines that people come within this collaborative work, you integrate conditions from different parts of the organization and different parts of society, different sectors, etc. Integration, I would say, runs throughout”*.

E1 linked KC8 to the B-Step by emphasizing how it supports integrated problem-solving: *“And understanding how that steps contributes to the overarching development of a solution reflects your ability to continuously develop your integrated sustainability problem-solving competency”*. E2 did not contribute or discuss any alignment or non-alignment between KC8 and its development in the B-Step.

Neither of the experts contributed or discussed any alignment or non-alignment between KC8 and its development in the C- or D-Steps, respectively.

4.1.9 Other Results

Some findings from the expert interviews did not relate directly to specific ABCD Process steps or individual KCs but offered insights into the broader conditions under which KCs may be developed throughout the process.

Both experts emphasized the interconnected nature of the KCs, which supports the idea that the ABCD Process may not foster each competency in isolation, but rather as part of an integrated whole. E1 noted, *“The key competences always come as a package deal, [...] they come as a family of competencies. [...] We need to train ourselves in all of them”*. They further explained that even when focused on developing a certain KC, other ones are developed as well, as they are interconnected. E2 echoed this sharing that they believed the KCs were interrelated.

The nonlinear and iterative structure of the ABCD Process was also highlighted as an important condition for how competencies developed. E2 explained, *“The ABCD is not a linear process. [...] You have flashes of thoughts of all those [steps] all the time, [...] you also iterate this over and over again”*. E1 further emphasized the role of intentional learning and self-awareness in making the most of the ABCD Process for the development of KCs: *“It’s always extremely helpful to be aware of what you want to learn. [...] Building awareness and building literacy on the competencies that allow us to do the work that want to do good, and even better, that helps in building that competency”*. E1 suggested that recognizing and articulating learning goals could enhance how practitioners develop competencies while applying the process in professional settings. Further details on contextual factors can be found in section 5.2.

4.2 Results from Phase 2: Interviews with Practitioners

This section contains the results from the practitioner interviews, summarized in the conceptual heatmap below. Later, the results for every KC are presented in detail, structured as first, an overview of the connection to the ABCD Process (noting that a competency with fewer than 13 mentions for the whole process may reflect step-specific associations rather than non-alignment), second, the “Top KC” rating, third, the step-by-step analysis (A-, B-, C-, D-Step), fourth, the non-alignments and lastly, dependencies or contextual factors, if any.

Table 4.2. Practitioner-informed conceptual heatmap. For details & legend see section 3.4.1 .

Mentioned times of KC	Systems Thinking (KC1)	Futures Thinking (KC2)	Values Thinking (KC3)	Strategies Thinking (KC4)	Implementation (KC5)	Inter-personal (KC6)	Intra-personal (KC7)	Integration (KC8)
ABCD Process	13	13	10	10	5	12	11	9
Top KC	4	5	2	2	0	2	2	0
A-Step	9	9	7	2	0	4	3	1
B-Step	6	1	3	2	0	2	0	2
C-Step	2	2	2	4	1	4	0	3
D-Step	1	2	3	7	4	3	0	4
Non-alignment	0	0	0	1	5	0	2	0

Table 4.2 shows the number of practitioners who mentioned connections of the KCs to the ABCD Process in their interviews. The results show that all KCs are developed throughout either the whole ABCD Process or, to a different extent, in certain steps. The most frequently linked KCs to the whole ABCD Process and any of its steps were Systems Thinking and Futures Thinking with 13 mentions in the entire ABCD Process, followed by Interpersonal Competency with twelve mentions. The highest number of Top KC mentions was Futures Thinking (five), followed by Systems Thinking (four). Implementation and Integration Competency emerged with the fewest overall mentions along the process and the individual steps and no Top KC mentions. Finally, Implementation Competency appeared with the highest non-alignment rating (five).

4.2.1 Systems Thinking (KC1)

KC1 emerged as one of the most frequently related KCs to the whole ABCD Process with mentions from all **13** interviewees and **four** (P5, P9, P11, P13) explicit rankings as one of the Top KCs.

P1 summarized the centrality of KC1 as *“the ABCD Process is rooted in Systems Thinking”*. Six interviewees (P1, P5, P6, P8, P9, P13) mentioned that the ABCD Process helps with grasping the interconnectedness between different stakeholders and their influence on each other, including the transparency of the value chain and stakeholder relationships, thus fostering KC1. As P13 shared, the ABCD Process facilitates, *“understanding the complexity and interconnectedness of many different actors within those systems. So that could also be a how a company and the product is part of a value chain for instance, and how it really connects to so many different points forming a very complex network”*. Three interviewees (P2, P3, P12) pointed out the connection and influence of their daily decisions to the bigger natural system, i.e. the biosphere, with P2 noting that even a simple introduction to nested systems (e.g., the economic system nested within the social system which is nested within the biosphere) offers participants *“a little bit an idea of Systems Thinking”*.

Additional insights, each mentioned by at least one interviewee, add nuance to how the ABCD Process facilitates the development of KC1. These include that the ABCD Process adds value so practitioners *“don't end up in these silos and one by one trying to do things, and then we just don't consider the consequences”* (P11), highlighting the importance of KC1. Moreover, the ABCD Process supports understanding trade-offs and crafting criteria that help in navigating them (P14). P1 mentioned that the ABCD Process facilitates KC1 by being able to reflect on their company's business model: *“The CEO at the end [...] said ‘When I started this process, I thought I would learn how to make my job in a greener way. But I actually realized that I need to rethink my business model. Me – doing a little piece of metal, sending it and never seeing it back again – it's not circular. It cannot work’”*. Another interviewee (P9) shared that the ABCD Process helps participants expand their understanding of their context and impact, thus fostering KC1.

In the A-Step, KC1 is seen as fundamental by nine participants (P1, P4-6, P10-14), fostering a shared understanding of sustainability and the sustainability challenge through recognition of the complexity and interdependence of natural and man-made systems. The shift in perspective was described as a *“mind shift for most people”* (P12) when beginning to see the natural environment as encompassing society and the economy. P1, P4, and P11 shared that KC1 is developed when defining and scoping a project, to be aware of the boundaries of the systems and their external dependencies. The development of KC1 occurred particularly through

learning to analyze systems and understanding their interconnections, as P10 explained, *“If you don't have Systems Thinking, you will maybe solve something, but you will create other challenges. So, applying Systems Thinking to that vision [A-Step] is just a fundamental requirement”*.

Six interviewees (P4, P9, P11-P14) shared their observations of connections between the ABCD Process and KC1 in B-Step. The house model and the stakeholder analysis were described as elements of the B-Step that foster KC1, connecting to the point of value chain transparency and stakeholder relationships above. Moreover, KC1 plays a role in analyzing the current state of a system by examining the interconnections and other factors that shape present conditions as exemplified by P11's reflection: *“B-Step is where we are right now and all the things that has put us where we are right now[...] due to circumstances and the way the world works”*.

Two people (P12, P13) observed the development of this KC in the C-Step, extending the approach by encouraging solutions that address entire systems rather than isolated parts of one system, as P12 shared: *“When we have that brainstorm [we asked:] ‘What are the things that you could do as a company that would put more water back into the system?’ [...] They start getting creative around [...] creating an ecosystem that allows for water to be regenerated”*.

Finally, P13 observed the competency development in the D-Step, where participants must prioritize actions while grappling with systems complexity, trade-offs, and potential unintended consequences. They remarked *“it gradually builds up this kind of getting familiar with the Systems Thinking. Especially in the C- and D-Steps where people really start running into [...] the challenges that come with Systems Thinking and the complexity that you then encounter”*.

4.2.2 Futures Thinking (KC2)

Following the same trend as the previous competency, KC2 appeared to be highly related to the ABCD Process, as a whole, according to all **13** interviewees, with **five** ratings (P2, P5, P10, P11, P14) as Top KC.

Backcasting, which develops KC2, was a theme mentioned by six interviewees (P1, P3, P4, P5, P11, P12) as an essential characteristic of the ABCD Process, as opposed to forecasting. As P1 shared, *“the ABCD obviously is based on [...] backcasting from principles. So it is Futures Thinking in a way that is actually different from your Futures Thinking [referring to UFCAST], where there are simulations, forecast, and scenarios. [...] It is Future Thinking in a way that is even more important: [...] the ABCD is designed to work with Futures Thinking in a complex system”*. Three interviewees (P6, P8, P10) mentioned that it opens space for investigating the very long-term and far future. P5, P8, and P10 added that this KC is especially important for leadership roles, with P8 explaining the benefit of the ABCD Process in fostering KC2 in their management team, *“If the Managing Director doesn't understand [Future Thinking], then it's hopeless, you know, because he's always the boss. So, it doesn't matter how much and what I say if he doesn't agree with me. And I think that has been really helpful”*. Another two practitioners (P13, P14) talked about the understanding of which value a product or company can provide in a fully sustainable future – instead of sustainable improvements of the product – as an attribute to the development of KC2. The stepwise approach through the A-, B-, C-, and D-Step, was mentioned as a further benefit by P8 when planning for sustainability, in addition to the need for a paradigm shift. As P5 noted, the ABCD Process facilitates *“a paradigm shift of being able to think long-term and connect the short with the long-term”*. Moreover, according

to P4, the ABCD Process supports the development of KC2 by encouraging thinking about the future “*without constraint*”, guided by SPs.

This KC is seen as strongly present in the A-step where nine (P4-6, P8, P10-14) interviewees pointed out the need for a Futures Thinking mindset to be able to craft a sustainability vision for an organization or a product. An emergent pattern was the element of backcasting that fosters KC2 (see above), which was connected to the A-Step by several interviewees. Furthermore, P12 shared that KC2 is not taught but rather left open for participants to visualize the future by themselves, “*I try not to teach. I believe that if you ask people to visualize the future [...] that’s part of the transformation of their thinking*”. Another interviewee (P6) described how the iterative nature of the ABCD Process helped foster KC2. They explained how starting with a diverse depth of understanding of KC2 from each participant in the ABCD Process got stronger throughout of the process, “*I would say they [Futures Thinking] got stronger because [...] as you start doing the work [ABCD Process], you know each individual might have [...] their own perception. And then you dig into it and then you share, and then you go back and dig more and then you share more. So [...] that was a deepening of [...] that competency*”. Moreover, the focus was laid on the long-term view facilitated by the A-Step, which is developing KC2, as this quote describes: “*Especially I would say the A-Step of having this long-term view of ‘Okay, if our products should be around in a sustainable society, this is where we in the very long term need to go’*” (P13).

The B-Step appeared to have a less evident connection to KC2 as only one interviewee mentioned it (P14), without giving further details.

The C-Step was mentioned by two participants (P3, P14) concerning KC2. P3 noted its role in supporting the brainstorming process through creating possible solutions “*in a way that led to where we want to go*”.

Two interviewees (P8, P14) described a connection of KC2 with the D-Step. In particular, P8 stated that a necessary part of a company’s strategic plan is to prioritize projects that show their importance only in the future, “*So of course that’s one thing that we prioritize that don’t solve anything here today. But we know it’s important for our work and it will help us in the future*”. No other details were provided regarding the development of KC2 within the C- and D-Step.

4.2.3 Values Thinking (KC3)

KC3 emerged as related to the whole ABCD Process for **ten** interviewees (P1, P2, P4, P5, P6, P9, P10, P11, P13, P14) with **two** rankings (P9, P11) as one of the Top KCs.

Five interviewees (P4, P5, P8, P9, P14) expressed that the development of KC3 is fostered by the clarification of the definition of sustainability that the ABCD Process provides, the SPs. P9 shared that “*people’s values [were] emerging [...] when they understood what sustainability means, according to the Sustainability Principles. [...] When they had that lens, they were able, according to their values, to point to certain issues that the company had that they were not thinking of sustainability issues*”. They further added that including the social dimensions to the definition was helpful, “*It was a very common comment [...] that they didn’t know the sustainability had a social side*”. The FSSD was highlighted by P5 as beneficial for the development of KC3 because it provides higher “*clarity about having used the [Sustainability] Principles to define the end state or the conditions for success*” than other frameworks, “*it’s not just like pick an SDG and run with it*”.

Three practitioners (P4, P5, P12) shared that the ABCD Process develops KC3 by supporting one to think about their values more actively. P4 said that they see the ABCD Process as more than just a strategic planning tool, but as one that includes social and sustainability values into strategy formation, *“Values is something that people have inherently and that we bring with us. With the [ABCD] procedure [it] becomes clearer to people how to actually apply that within a strategic planning context. [The ABCD Process] supports people to think about that [sustainability as a value] in a more active way”*.

Another two interviewees (P11, P12) expressed that the ABCD Process fosters the development of KC3 by ensuring integrity, *“that has to do with what you are and what you want to be”* (P11).

Two interviewees (P1, P8) mentioned that the development of KC3 takes time and stepwise improvements, e.g., *“The more you work with sustainability, the more important your values get there”* (P8), highlighting that sustained involvement in sustainability practice naturally brings values into sharper focus. Similarly, P1 described a developmental arc in which values emerge progressively through action, rather than needing to be fully formed at the outset, *“At the end of the day, it’s important to start the journey. [...] You act a bit more; your values go up a bit more”*. Together, these perspectives illustrate a shared pattern that KC3 is not a prerequisite for action, but rather, it is cultivated through ongoing engagement with the ABCD Process that creates reflective and participatory space for values to surface and evolve. Another insight on the development of KC3 included that the ABCD Process fosters showing oneself more authentic, as P6 shared, *“You show up as humans. [...] And then it becomes very values-oriented and personable”*, which enhances the development of KC3.

Seven interviewees (P3, P5, P6, P9, P12-14) expressed that KC3 is especially present in the A-Step, as defining sustainability in this step fosters KC3 (see above). P13 reflected, *“As soon as we talk about, you know, filling a vision more for a specific context within the boundaries of the SPs, then you have to apply Values Thinking”*. Several practitioners added singular views, enriching in what way KC3 gets developed: P3 highlighted that values get transparent, and therefore KC3 developed, when brought to the conversation in the A-Step, *“What do people value? ‘This over that’, ‘in this amount of time’. [...] And this is where also a lot of conflict is happening”*. P6 shared that KC3 is fostered when developing a purpose and when having value-based discussions on relationships with oneself and others. Another point was raised by P9 when they shared that the activities of the A-Step enhanced KC3: *“They were creating these nice titles for their company's future. [...] I think that their values emerged and connected to sustainability”*.

KC3 is reflected by three interviewees (P1, P9, P13) in the B-Step, saying that assessing the current reality through a sustainability lens needs some normative judgment and consideration of values. As P13 noted, even when measuring a product's current state, *“you still have to do some kind of normative judgment. Because there's no objective way of comparing this alternative giving you know it causes the emissions of, say, 10 kilograms of lead. And this alternative has the risk for 100 hours of child labor. There's no objective way you could compare the sustainability impact of two different alternatives, so you have to include some kind of value judgment even in the B-Step. Because otherwise [...] there's no way of making completely objective assessment of sustainability”*. Another practitioner (P9) shared that by highlighting social aspects of sustainability alongside environmental ones in the B-Step, the understanding of relevant sustainability values can also be broadened.

For the C-Step, two interviewees (P13, P14) mentioned the connection between KC3 and the ABCD Process, without elaborating further details.

Three interviewees (P12, P13, P14) described a connection in the D-Step, as this step provides an opportunity to develop KC3 by allowing reflection and prioritization based on values, e.g., *“If you start coming down to maybe it in the D-Step, that's where values can start to become a little bit problematic. Because when you are prioritizing, people start to prioritize different things”* (P12).

4.2.4 Strategies Thinking (KC4)

Before providing details, it is important to note that some practitioners used the terms Strategies Thinking and Strategic Thinking interchangeably, the results are therefore presented using both as an indicator for KC4 (see section 5.1.4). KC4 was mentioned as developed when working with the ABCD Process, as a whole, by **ten** interviewees (P1, P3-6, P9, P11-14), and **two** (P11, P13) ranked it as a Top KC. **One** participant (P2) found a non-alignment of this KC with the ABCD Process.

With more nuance, three interviewees (P2, P10, P12) expressed that the ABCD Process facilitates the application of KC4 by incorporating discussions about the trade-off between sustainability and profit. Two interviewees (P1, P5) stated that the ABCD Process is valuable for rethinking the whole business model, and thus enhancing the ability to construct viable strategies, which is a defined element of KC4. The systematic procedure of the ABCD Process, even as just a mental model, was brought in by two interviewees (P3, P8) as helpful to *“structure things up”* (P8), reflecting on the development of KC4. One interviewee (P14) explained that the ABCD Process supports KC4 by fostering the integration of long-term sustainability considerations and criteria in early-stage product development. This approach makes a product strategically more prepared to meet various sustainability scenarios of the future: *“We have seen that it's really important to have leading sustainability criteria in place at a very early stage in product development because of the fact that the sustainability profile of a product is largely determined in the [...] really early stages of innovation”* (P14).

Two interviewees (P6, P13) connected KC4 with the A-Step. P6 reflected that starting with a vision provides value for constructing strategies, *“Of course the strategic approach – so how to, why do we start with the visioning part? Why is that important? And especially when it comes to sustainability transitioning work – so that also brings that to the table, to a deeper understanding and a [Strategies Thinking] competency around that”*.

In the B-Step, two practitioners (P5, P9) noted that KC4 is developed through the process of identifying the gap between the current state and the envisioned sustainable future. P5 described this as defining and analyzing the gap to ideate strategic actions. For P9, the ABCD Process helps companies to move beyond superficial sustainability efforts (e.g., office recycling) and address more strategic, core issues like problematic materials in their value chain, thus supporting participants' Strategies Thinking by helping them identify key issues and focusing their efforts.

Notably, higher numbers of the development of this KC were identified within the C-Step (P10, P11, P13, P14) and the D-Step (P4, P5, P9, P10, P11, P13, P14). P10 noted that in their work, KC4 is *“part of the normal strategy process where we are creating solutions and prioritizing”*, describing how their company creates their strategic plans towards sustainability with the

ABCD Process. The process of evaluating which concept, idea, or action is “the best” as part of the strategic plan toward the vision often occurs in the C- and D-Steps (P14). P11 explicitly stated that the C-Step was the specific step of the ABCD Process in which they thought KC4 got enhanced the most. Two interviewees (P13, P14) shared that they discussed and developed strategic guidelines based on the multitude of actions or ideas generated in the C-Step. Three interviewees (P4, P5, P13) highlighted the importance of the prioritization questions, offered in the D-step, for KC4. These guiding prioritization questions are described as “*extremely powerful*” in supporting Strategies Thinking (P5). Furthermore, P4 reflected on KC4 appearing as “*strategic guidelines for us to prioritize these [...] actions*” in the D-Step. They also observed that the team they worked with gained a clear understanding of how to be strategic and prioritize effectively, even while acknowledging the inherent challenges in doing so. Despite the complexity, the systematic nature of the ABCD Process was appreciated and positively received by the team. The prioritization as part of the D-Step is seen as “*really useful*” and has led to “*aha-moments*” about what KC4 truly means in practice, going beyond simply having an action list in an Excel sheet (P4).

Another perspective that one interviewee (P2) shared was that KC4 was not a big part of their work with the ABCD Process. They pointed out that the extent to which KC4 can be developed is highly dependent on the mindset and openness of the participants, and on contextual factors like short-term profit, “*I was not in a lucky position enough to have open-minded companies to really think long-term strategically. They were more thinking about how they can make profit and how they can turn in every action. [...] So that doesn't line up with [...] Strategies Thinking*” (P2). More details on the contextual factors can be found in section 5.2.

4.2.5 Implementation Competency (KC5)

KC5 was mentioned as developed in the whole ABCD Process by **five** practitioners (P4, P6, P9, P10, P13), however, **none** ranked it among the Top KCs. **Five** practitioners (P2, P5, P8, P11, P14) find that the KC is not aligned with the ABCD Process.

Three interviewees (P2, P6, P11) explained that KC5 is facilitated by the ABCD Process when done iteratively, with continuous status reports and monitoring. Two interviewees (P4, P6) expressed that KC5 is “*sort of built in*” (P6) in the ABCD Process. Furthermore, P9 shared a more indirect development of KC5 facilitated by the ABCD Process, as “*[in order] to solve the problem, you need to understand it first*”, implying that to implement a solution one should start by knowing the problem it is resolving and the ABCD Process is providing the space for that.

Four interviewees expressed how the ABCD Process is of value during the implementation phase of a project: P11 and P12 mentioned that during the implementation phase, it is helpful to review the vision done by the ABCD Process, to not fall back into day-to-day problems, and have a transparent strategic path that backs up the reason for implementation. P13 highlighted the value of the ABCD Process as a communication tool for implementation, enabling a clearer articulation of what should be implemented.

No interviewees linked the development of KC5 to the A- and the B-Step. One participant (P14) referred KC5 to the C-Step, and four (P1, P6, P11, P14) to the D-Step.

Besides the D-Step, no details were provided for the other steps. Two interviewees (P1, P6) mentioned that making decisions and prioritizing is the first step for implementation, and that the three prioritization questions, applied in the D-Step, are helpful for that: “*And then of course*

the D-Step brings to actions that should be easily implemented because they went through [...] three questions [D-Step prioritization questions]” (P1). P1 also shared that the D-Step helped with decision-making on whether to implement or not, which can develop KC5.

The reasons for non-alignment provided by the interviewees include that the ABCD Process is perceived *“as first and foremost [...] a planning tool”*, with its main purpose *“to create a strategic plan”*. And while it provides *“support for that step [planning]”*, it provides less support *“for the actual implementation”* (P13). Further explanation included that the consulting role often terminates before implementation begins, limiting a contribution to the development of KC5 (P9). P5 expressed that implementation demands a different skillset, *“This has been a long-term weakness of when the ABCD is applied because it’s kind of like ‘Oh, ABCD, [they] did [...] a visioning workshop [and] it got them all inspired’. And then they have to go away, and I think that it [Implementation Competency] requires different skillsets”*. While businesses may already exhibit a predisposition toward action due to their pragmatic orientation, this drive is not necessarily cultivated through the ABCD Process alone.

4.2.6 Interpersonal Competency (KC6)

KC6 emerged as developed during the whole ABCD Process by **twelve** (P1-P6, P8, P9, P11-P14) interviewees with **two** (P2, P5) rankings as one of the Top KC developed by applying the ABCD Process.

Ten interviewees (P1, P2, P4, P5, P6, P9, P10, P12, P13, P14) explained that the ABCD Process is helpful in bringing different perspectives, stakeholders, and understanding of sustainability to the table and combines one’s experience with those of others. The value of the transdisciplinary approach that the ABCD Process offers was highlighted, especially in interacting with other businesses, organizations, individuals, and actors across industries and value chains. This interaction fostered collaboration, dialogue, and the ability to engage with diverse perspectives, which are the key components of KC6. Furthermore, P2 and P10 mentioned the interdisciplinary understanding of the ABCD Process, e.g., working between different organizational levels (management vs. expert roles).

Two interviewees (P5, P6) noted that the ABCD Process, by its participatory nature, is fostering a sense of connection, collaboration, and hope, thus establishing a foundation for the development of KC6. Exemplary, P6 described the ABCD Process as an opportunity to *“get excited together again and [say] ‘Yes, we can do this!’”*. Another two interviewees (P2, P9) mentioned that the ABCD Process is helpful in the context of power dynamics, providing an opportunity for all voices in the conversation to be heard, which is crucial for developing KC6. The shared language, provided by the ABCD Process, was expressed by two interviewees (P5, P11) as helpful for the development of KC6, as P5 shared, *“So having a tool and a process that you can engage with the clients makes it easier to, it gives you kind of something to hang on to when you’re negotiating with them. About what is needed, what the process should include”*.

Three practitioners (P1, P11, P12) reflected that their Interpersonal Competency got more nuanced and experienced over time when working with interdisciplinary stakeholders in ABCD Processes. They shared, *“The more you use the ABCD, the more people you have used it with, the more it becomes [...] easier for this kind of Interdisciplinary [Competency]”* (P11), and *“Collaboration is a muscle as well. So if you practice your collaboration muscle, you’ll get better at collaborating”* (P1).

Four interviewees (P6, P11, P12, P14) shared that KC6 is developed during the A-Step. When asked openly which KCs are present in this step, P6 shared that KC6 is first coming to their mind, emphasizing the participatory nature of the A-Step. Working with “*groups or several groups in parallel*” requires participants to engage with diverse perspectives and cultivate “*collective intelligence and interpersonal*” skills (P6).

In the B-Step, two interviewees (P11, P14) noted a connection with the KC6, highlighting the importance of including as many different perspectives as possible and working with diverse groups of stakeholders to accurately understand the current reality.

The collaborative dimension during the C-Step, and therefore the development of KC6, was mentioned by four interviewees (P1, P5, P11, P14). P5 shared that involving many people in this phase creates a motivating environment in which participants inspire one another to engage deeply in the activity. Another participant (P14) emphasized that gathering a wide range of stakeholder perspectives enhances the quality of the process, reinforcing the interpersonal demands and benefits of collaboration.

Three interviewees (P4, P11, P14) shared that KC6 is developed in the D-step, especially as it involves stakeholder participation in decision-making, without mentioning further details.

Moreover, four interviewees (P2, P4, P6, P14) explained that they see the ABCD Process facilitating the development of the KC6 more indirectly and less dependent on the ABCD Process itself, e.g., that KC6 is “*more hidden in the background*” (P2). Details on the contextual factors that are shaping the development of KCs can be found in the section 5.2.

4.2.7 Intra-personal Competency (KC7)

Eleven interviewees (P1, P2, P4-6, P8-12, P14) affirmed that the ABCD Process, as a whole, facilitates the development of KC7, with **two** (P9, P14) ratings as Top KC. **Two** interviewees (P3, P13) see a non-alignment of this KC to the ABCD Process.

Six practitioners (P4, P5, P6, P8, P10, P11) mentioned that the ABCD Process facilitates the development of KC7 by providing a vision towards sustainability and knowing that there are possible solutions for a step-wise approach, with P8 sharing that “*It [the ABCD Process] is helpful to know where we are heading. I know where we're heading and I can't change the world on my own and I can't do it today, but I try. Just try to do it one step by step, and sometimes it's really frustrating, but sometimes you just have to accept*”. Having a clear roadmap and purpose-driven approach can also be “*very comforting to a lot of people*” (P10). Furthermore, six interviewees (P1, P3, P4, P5, P11, P12) explained that the ABCD Process supports in dealing with complexity and not getting overwhelmed, “*You realize how screwed up we are anyways in different areas, causing anxiety [...] and so on. [...] But with time you realize [...] the ABCD facilities this work [...], knowing that this is a way of dealing with the complexity*” (P4). Four interviewees (P5, P6, P10, P12) shared that the ABCD Process facilitates the presence of KC7 by providing inspiration, positivity, hope, and comfort for educators, facilitators, and participants in the process. Describing ABCD-based group conversations as emotionally uplifting, P6 said, “*I find that the ABCD actually opens it up and it brings people together in in more of a like higher spirit [...], [the ABCD Process] being open and inviting process with a positive future perspective brings hope at the table of collaboration*”. The clarity of a desired future provided by the ABCD Process can also be “*giving people hope and something to aim for*” (P12). P5 added that the process clarity “*gives*

me hope” and helps “*to show people there is hope*”. Three interviewees (P4, P8, P14) explained that the ABCD Process builds confidence and empowerment. P2 shared that KC7 is developed over time when applying the ABCD Process, “*The more you do it [the ABCD Process], the more you develop it*”.

Three interviewees (P5, P10, P12) expressed the development of KC7 especially in the A-Step. They emphasized that having a clear vision and roadmap during this step not only supports decision-making but also enhances personal motivation and commitment, as P10 highlighted the sense of comfort and clarity gained from following a structured vision. All three stressed the importance of fostering awareness not only of systems and sustainability but also of oneself, highlighting the need for self-awareness as an integral part of the A-Step. P12 discussed the role of listening at multiple levels, oneself, others, and the system. On another hand, they also noted that while the A-Step emphasizes awareness of the system, of sustainability, and of the individual, this last component is frequently omitted: “*Getting awareness about you as an individual is part of that and that has been missing in most cases. I've never seen anyone who does the A and includes individual awareness*” (P12).

No particular connections of KC7 with the B-, C-, and D-Step were mentioned.

The reasons provided for a non-alignment of KC7 and the ABCD Process add to that last quote of P12, with another interviewee (P13) reflecting that KC7 is rarely made explicit in the ABCD Process, stating, “*I think it's one of those competencies that is not explicitly [...] part of the ABCD, unless you really push it there. [...] I don't think we ever talk about intrapersonal aspects*”. The other interviewee (P3) shared that applying ABCD to oneself could develop KC7 with that specific focus, but it's considered a side effect.

4.2.8 Integration Competency (KC8)

KC8 emerged as related to the whole ABCD Process by **nine** interviewees (P2-6, P8-10, P14). **No** interviewees explicitly ranked it as one of the Top KCs.

For this KC, themes only appeared in one practitioner each. Exemplary, P4 expressed that the ABCD Process can help in building a “*shared mental model for people to have much more effective dialogues*”, and that the very purpose of an ABCD Process is “*to integrate all the values and problems and knowledge [...] into a common strategy forward*”. They further explained that especially the facilitator of an ABCD Process develops KC8, as their role is primarily to create the container setting and conditions that enable the collective knowledge and different perspectives to emerge and be integrated by the group, “*The procedure the ABCD works well while someone is there to facilitate and see that the process is ongoing and also when there are people like a core team that do have the core knowledge and about the procedure and the systematic way of working*”. P2 laid the focus in KC8 on the ability to apply the ABCD Process and with that work with the FSSD principles in a pragmatic way, “*[The FSSD is] too hard, too scientific... People don't get what it means. It's too complicated. Can we not do this simpler and turn it around? And we did [with the ABCD Process]*”. The importance of including learning in the ABCD Process was expressed by another interviewee (P12) when they shared, “*We actually run a process for them and in that process, we include the learning – what is it that they need to learn in order to be able to embrace the ABCD logic*”. Further descriptions of how the ABCD Process facilitates the development of KC8 were that it supports in dealing with trade-offs (P10), the simplicity of the ABCD Process (P5), and helps in connecting “*both right and left brain*” (P12).

One practitioner points out a relation of KC8 in the A-step (P6), two in the B-step (P6, P9), three in the C-step (P6, P9, P14) and four in the D-step (P6, P9, P13, P14). Interviewees acknowledged the presence of KC8 with brief affirmations such as “*yes, it’s there*”, but did not provide further elaboration on how it manifests, specifically in the A- and B-Step. However, they expressed that KC8 is more evident in the C- and D-Step, where solutions are created and combined (P6, P13, P14).

Three people (P2, P10, P14) explained the difficulty in understanding the definition of KC8, “*I think this competence is really hard to wrap my head around*” (P14).

4.2.9 Other Results

In addition to the results mentioned above, interviewees expressed the development of a KC in facilitators and participants, when leading or taking part in an ABCD Process, with different intensity. A pattern was notable that the Systems Thinking, Futures Thinking, and Interpersonal Competency were mostly connected to be developed in participants of an ABCD Process, while the latter one was, together with the Intra-personal Competency, mostly mentioned when asked about the development in facilitators of an ABCD Process. However, the data was not present for all KCs and interviewees (see section 5.3).

Furthermore, the gathered data demonstrates strong interdependence between the KCs. Interviewees mentioned one to five connections of every KC to another KC, e.g., “*So being able to handle that [Interpersonal Competency] effectively is a very important competence to achieve Implementation [Competency] because you are dependent on working together with these people, you can't do it alone*” (P13).

5 Discussion

The purpose of this section is to discuss and compare the findings from interviews with practitioners and experts, while answering the research question and linking them to existing literature, to identify implications for practice and future research. Each KC section will begin with a table juxtaposing the data from the conceptual heatmap from experts (Table 4.1) and practitioners (Table 4.2). For the logic behind the color gradients used in both heatmaps, please refer to the Section 3. Showing these visual representations side by side allows for a nuanced analysis of patterns and differences between conceptual frameworks by experts and practitioner perspectives, moving beyond numerical comparison to discuss the qualitative dimensions of the KCs development within the ABCD Process.

5.1 Detailed Discussion per Key Competency

5.1.1 Systems Thinking (KC1)

Table 5.1. Heatmap Comparison of Experts & Practitioners: Systems Thinking.

	EXPERT	PRACTITIONER
ABCD Process		13
A-Step		9
B-Step		6
C-Step		2
D-Step		1

KC1 is viewed by experts as a core competency that is developed in the ABCD Process because of its systematic approach. Experts assert the critical role of KC1 across all ABCD steps, reflecting the need to address sustainability challenges as complex, interconnected systems, a perspective shown in literature noting that ecological, social, and economic dimensions are deeply nested and interlinked (Liu et al. 2015). As shown in Table 5.1, practitioners generally shared the same opinion of the ABCD Process as supporting the understanding of stakeholder networks as well as unintended consequences of systems interactions, with all 13 interviewees recognizing KC1’s development in the ABCD Process. Particularly, in the A-Step, they noted a deepened awareness of nested systems and interdependencies, and less frequently identified its development in the B-, C-, and D-Steps. They specifically highlighted how the introduction of nested systems concepts acts as a “mind shift for most people” (P12), that is how KC1 is cultivated in participants. Additionally, it was suggested that guiding others through the systemic analysis built into the ABCD Process also strengthens the facilitator's capacity.

The similarity between experts and practitioners suggests that while the structural design of the ABCD Process fosters KC1, its development is experienced unevenly across the steps, with both perceiving it as more prominent in visioning and less so in later steps. Possibly, this is reflected because the A-Step is designed to ground participants in the fundamental understanding of the sustainability challenge within the broader systemic context before any analysis or generation of solution begins. The process of defining a desirable future within SPs naturally engages participants in contemplating complex interconnections and concepts related to nested systems, potentially linked to the Funnel Metaphor (Broman and Robert 2017). Wiek et al.’s (2011) framework defines KC1 as essential for addressing sustainability’s complexity by analyzing interdependencies across systems. The B-Step is seen to align with this finding based on the practitioner interviews by requiring participants to engage with such complexity, as they were examining the interconnections and other factors that shape present conditions.

KC1 is most naturally developed during the reflective A- and B-Steps, which focus on awareness and analysis of interconnectedness between systems. Moreover, its growth could be strengthened in the action-focused C- and D-Step if practitioners gain more hands-on experience, especially as they face growing challenges and complexity while repeating the process over time. In summary, all practitioners who recognized a link between the development of KC1 and the ABCD Process reported that it is cultivated through learning to analyze systems and interconnections, as well as by navigating the complex nature of sustainability challenges. This aligns with literature that defines KC1 as the ability to understand, describe, and analyze complex sustainability issues, including patterns, structures, feedback loops, and interactions across domains, scales, and perspectives (Redman and Wiek 2021).

5.1.2 Futures Thinking (KC2)

Table 5.2. Heatmap Comparison of Experts & Practitioners: Futures Thinking.

	EXPERT	PRACTITIONER
ABCD Process		13
A-Step		9
B-Step		1
C-Step		2
D-Step		2

KC2 is consistently emphasized in the foundational theories proposed by Wiek et al. (2011) and Redman and Wiek (2021), who identify Futures Thinking as essential for navigating the complexity and uncertainty of sustainability challenges. This perspective is realized by both experts and practitioners in relation to the ABCD Process. While Table 5.2 indicates no explicit expert attribution for the development of KC2 within the ABCD Process as a whole, this absence reflects a lack of direct quotes covering the entire process rather than an absence of relevance. In practice, KC2 was clearly observed to emerge in the ABCD steps. Experts noted that KC2 is present in all four steps of the ABCD Process, and especially prominent in the A-Step, where envisioning a sustainable future, grounded in the SPs, necessitates a backcasting approach. This directly reflects Broman and Robèrt's (2017) emphasis on backcasting from SPs as a core mechanism for SSD, situating KC2 as fundamental to the ABCD Process. Moreover, experts note that KC2 is also crucial in the B-Step, as practitioners must analyze the current state against a future vision, as well as in the C-Step, where prioritizing actions necessitates a future-oriented perspective, maintaining long-term goals. This operationalization of KC2 throughout the ABCD Process supports the argument made by Brundièrs et al. (2021) that certain competencies are activated at different stages of integrated sustainability problem-solving.

The alignment between experts and practitioners highlights that the ABCD Process fosters the development of KC2 by centering strategic planning around a future vision, with a stronger emphasis on the A-Step. Specifically, the A-Step serves as the step that utilizes backcasting the most, setting a clear vision that guides subsequent steps (B, C, and D). Moreover, experts note that the visioning process is not only about envisioning desirable futures but also about fostering creativity and imagination. Although creativity and imagination are also linked to brainstorming in the C-Step, the A-Step's vision creation requires imaginative thinking about how the future can be. While KC2 is acknowledged in the B-, C-, and D-Steps, it plays a more applied role, guiding current reality analysis, action brainstorming, and prioritization based on future impact. Practitioners offered less elaboration on how KC2 develops in these later steps, indicating similarly that the competency's development may be most pronounced during the

visioning phase in the A-Step. Moreover, the iterative nature of the ABCD Process contributes to the development of KC2 by allowing ongoing refinement of plans, encouraging both participants and facilitators to continuously engage with future scenarios and adapt strategies based on evolving insights. Also, practitioners see KC2 as essential for leadership in the ABCD Process, noting its role which makes it ‘easier’ to get management’s support for strategic sustainability planning and decisions, a point that echoes the literature’s call for sustainability leaders who can navigate adaptive systems with future-oriented change (Metcalf and Benn 2013; Sajjad et al. 2024).

5.1.3 Values Thinking (KC3)

Table 5.3. Heatmap Comparison of Experts & Practitioners: Values Thinking.

	EXPERT	PRACTITIONER
ABCD Process		10
A-Step		7
B-Step		3
C-Step		2
D-Step		3

As presented in Table 5.3 above, both experts emphasized that KC3 is integral to the A-, B- and D-Steps, with only one mentioning that it is developed also in the C-Step. They highlight that the A-Step’s visioning within SPs, while scientifically derived and intended to be as free from values as possible to facilitate agreement, also serves to clarify precisely where values come into play. The B-Step involves comparing existing organizational values to sustainability norms, the C-Step sees values influencing ideation, as observed by E2 “*Values will always influence the ideas we come up with, and they should*”, and the D-Step requires value-based prioritization. Practitioners generally align with this view, recognizing that the A-Step facilitates development of KC3 by prompting reflection on organizational and sustainability values. The B-Step necessitates value judgments during assessments and comparing different types of impacts (e.g., emissions versus child labor risk) linking to the competency’s description like “*assess sustainability principles, morals, norms, ethics*” and dealing with potential trade-offs (Redman and Wiek 2021). The D-Step involves prioritizing based on values and how this is the step where values can become “*a little bit problematic*” (P12) by requiring participants to confront the reality of competing values and make trade-offs when choosing which solutions to pursue. However, the development of KC3 was less observed in the C-Step, suggesting that the role of values in ideation may be less explicit or harder to articulate.

This comparison reveals that while experts see KC3 as a continuous thread throughout the ABCD Process, practitioners identify its development in more isolated insights, suggesting a gap between how KC3 is theorized to frame every step and how it is experientially recognized. Although KC3 is embedded across the ABCD Process, its development may depend on facilitation that actively surfaces values, particularly in later steps where competing priorities and normative tensions arise.

5.1.4 Strategies Thinking (KC4)

Table 5.4. Heatmap Comparison of Experts & Practitioners: Strategies Thinking.

	EXPERT	PRACTITIONER
ABCD Process		10
A-Step		2
B-Step		2
C-Step		4
D-Step		7

Throughout the interviews with experts and practitioners, the terms “Strategic Thinking” and “Strategies Thinking” were used interchangeably, sometimes even by the same individual. This overlap in terminology is even seen in the foundational literature on the KCs, which does not explicitly differentiate the two: Redman and Wiek (2021) use the terminology “Strategies Thinking”, Brundièrs et al. (2021) and Wiek et al. (2011) use “Strategic Thinking”. All refer to the same underlying competency: the ability to design and implement sustainability interventions through the use of systems-based and future-oriented perspectives. Given this, it is understood that experts like E1 use the terms fluidly while still holding their interpretation closely to the competency’s core definition. However a slightly different variation of “Strategic Thinking” comes from the other expert and the FSSD: the ability to create and apply adaptive, economically viable, and future-oriented pathways towards sustainability, while navigating trade-offs and iteratively revising plans (Broman and Robèrt 2025). Furthermore, it was apparent that practitioners’ understanding of the “Strategies Thinking” or “Strategic Thinking” competency closely aligned with the conceptualization put forward by Broman and Robèrt (2025).

As illustrated in Table 5.4, KC4, conceptually encompassing both the development of specific strategies and the broader aptitude of Strategic Thinking, is broadly acknowledged by experts and practitioners as a core competency embedded in the ABCD Process. Experts see KC4 as integral to the ABCD Process with a strong emphasis on the D-Step’s prioritization. Practitioners align with this view, with most connecting the creation of strategies through prioritization in D-Step as the key factor to the development of KC4 within the ABCD Process. This focus by experts and practitioners on the D-Step reflects the step’s important role in the development of KC4, especially by the detailed development of specific sustainability strategies.

Moreover, experts viewed KC4 as inherently tied to the ABCD Process’ overall structure, emphasizing its theoretical design as a strategic planning tool. This view strongly connects with the concept of “Strategic Thinking”, as KC4 not only supports the future-oriented aspects of the entire ABCD Process but also enables the effective navigation of trade-offs. Experts offered diverse perspectives on how the A-Step fosters KC4, with E2 highlighting its alignment with the A-Step as a foundational vision-setting phase, while E1 countered that KC4 develops after the A-Step, requiring both the vision from A-Step and the current reality from B-Step as reference points. This suggests a sequential dependency, where KC4 builds on the outcomes of prior steps rather than emerging independently in the A-Step. Moreover, E2 views KC4 as critical for the gap analysis in the B-Step, both experts see it in a limited form tied to idea generation in the C-Step. In the D-Step, E1 considered it a primary competency for prioritization, with E2 affirming its alignment based on the definition of KC4. These insights could come from how experts look at the process from a high-level viewpoint, focusing on its theoretical foundation and how the competency logically fits within that structure, rather than being shaped by specific, ground-level experiences or variations in application. Furthermore, practitioners, drawing on their hands-on experience, provided insights into the development of KC4 through the C- and D-Step, by brainstorming transformative solutions and prioritizing them with strategic, future-oriented criteria. Specifically, this could be debating ideas that align with a sustainable vision, embedding sustainability into core functions, and fostering strategies that address immediate needs while ensuring long-term socio-ecological benefits. This aligns with Baumgartner and Rauter’s (2017) emphasis on the importance of strategic thinking in sustainable development, focusing on long-term planning for shared societal and environmental value, as the steps encourage practitioners to integrate sustainability into decision-making for sustained, mutual impact. Additionally, the D-Step’s prioritization phase, involving complex

trade-offs to distill actionable guidelines, deepens KC4 by moving beyond simple action lists to embody strategic prioritization, resonating with Baumgartner and Korhonen’s (2010) call for strategic navigation of complexity to avoid trade-offs and problem displacement. This layered, practical engagement complements experts’ theoretical framing, illustrating how the ABCD Process fosters KC4 through iterative, context-driven application.

5.1.5 Implementation Competency (KC5)

Table 5.5. Heatmap Comparison of Experts & Practitioners: Implementation Competency.

	EXPERT	PRACTITIONER
ABCD Process		5
A-Step		0
B-Step		0
C-Step		1
D-Step		4

As seen in Table 5.5, the connection between KC5 and the ABCD Process was perceived differently by experts and practitioners, and it was less strongly linked compared to the other KCs. Experts view KC5 as outside of the ABCD Process’ core design, considering its development to be indirect. E2 acknowledged the need for iterative implementation of plans, yet neither expert tied it directly to specific ABCD steps. E1 emphasized a clear separation between the process’ planning focus and practical execution. Practitioners were similarly divided: five saw no alignment, viewing the process primarily as a planning tool, while four others associated it with the D-Step’s prioritization, considering it a foundational step for action, and three valued its iterative nature for fostering adaptability in implementation.

Specifically, the subtly distinct perspectives on KC5 between experts and practitioners are evident when considering the development of KC5 in the ABCD Process, as a whole, and in the D-Step. Experts perceived no direct connection, likely due to their emphasis on the planning focus of the ABCD Process, as it has been designed as a planning tool. Most practitioners aligned with the experts’ view, some noted limited development of KC5 through practical implementation readiness, indicating that the ABCD Process helps practitioners and companies in becoming better prepared for the implementation phase of sustainability initiatives. This development occurs by incorporating contextual factors such as engagement of the facilitator and the influence of organizational context and mindset (see section 5.2), which experts deemed external to the ABCD Process’ core design. It can be interpreted that while the ABCD Process does not have a dedicated step for implementation, it provides the conditions needed for implementation. The research’s result suggests that the ABCD Process subtly supports KC5 by fostering ownership and structuring prioritized actions through the three strategic prioritization criteria (in the D-Step) and iterative refinement. This indicates that, theoretically, the core design of the ABCD Process prioritizes planning over hands-on skills, yet practically, it may enhance KC5 modestly with external support. However, it is important to note that there was scarce data collected about implementation development through the ABCD Process, as many practitioners interviewed rarely got to execute implementation in their sustainability initiatives because integration into broader organizational routines and cultures is often lacking. This resonates with Naudé’s (2014) critique that sustainability initiatives are often treated as stand-alone projects rather than integrated strategies, meaning implementation receives less focus when sustainability is not embedded within the company’s structure. Moreover, the iterative nature of the ABCD Process, as noted by some practitioners, supports adaptability in implementation, resonating with Guido et al. (2012), who emphasize the importance of adaptive frameworks for navigating the complexity of socially just development pathways. This iterative engagement, while not a substitute for hands-on implementation training, may foster a sense of

ownership and readiness for action among participants, particularly when supported by strong facilitation and organizational alignment.

5.1.6 Interpersonal Competency (KC6)

Table 5.6. Heatmap Comparison of Experts & Practitioners: Interpersonal Competency.

	EXPERT	PRACTITIONER
ABCD Process		12
A-Step		4
B-Step		2
C-Step		4
D-Step		3

Both experts and practitioners affirmed that the development of KC6 is associated with the ABCD Process as seen in Table 5.6. Experts affirm its relevance, emphasizing that the collaborative and stakeholder-inclusive nature of the ABCD Process fosters interpersonal skill development. This aligns with Wiek et al. (2011), who identify KC6 as essential for transdisciplinary and participatory contexts. This is especially true in the A-Step’s collective visioning. Experts did not tie or deny KC6 explicitly to the B-, C-, or D-Steps, although there is evidence of connection from the literature of the frameworks (Brundiens et al. 2021). Similarly, practitioners highlighted that KC6 is developed throughout the whole ABCD Process, though its expression can depend on context. Some saw it as “*more hidden in the background*” (P2), shaped by participants’ experience and facilitator skill, while others emphasized its emergence through the transdisciplinary nature of the ABCD Process. This suggests that KC6 emerges through a combination of process design and the broader social and organizational context in which it is applied. This observation is supported by literature (Ibid), arguing that the development of KC6 in sustainability education is highly context-dependent and influenced by facilitation and group dynamics. Beyond the A-Step, practitioners also linked KC6 development to the B-, C-, and D-Steps. For instance, understanding diverse stakeholder realities in the B-Step, fostering motivation and collaboration in the C-Step, and participatory decision-making in the D-Step were all cited as contexts where interpersonal skills come into play.

Importantly, practitioners highlighted that the extent of the development of KC6 is significantly influenced by contextual factors (see section 5.2). The ABCD Process is also seen as providing a shared language and tool for engaging clients and navigating discussions and power dynamics, helping ensure that all voices are heard and that mutual respect is fostered.

5.1.7 Intra-personal Competency (KC7)

Table 5.7. Heatmap Comparison of Experts & Practitioners: Intra-personal Competency.

	EXPERT	PRACTITIONER
ABCD Process		11
A-Step		3
B-Step		0
C-Step		0
D-Step		0

Experts and practitioners demonstrated consensus on the development of KC7 through the ABCD Process as a whole, as shown in Table 5.7. However, aside from the A-Step, no other step was identified by both groups as contributing to the development of this KC. Experts viewed KC7 as a foundational necessity for engaging in the ABCD Process, emphasizing its role in helping individuals manage the emotional demands of sustainability work and

contributing effectively in collaborative settings, particularly during the A-Step’s visioning. E2 noted that the ABCD Process indirectly fosters KC7 through the SPs’ focus on health as a boundary condition for visions developed in the A-Step. Even though Intra-personal development is not explicitly designed into the process, it is not excluded either. They therefore emphasized that the ABCD Process leaves the space open for KC7’s development. Practitioners added a practical dimension to the development of KC7, attributing it to the structured roadmap to the vision provided by the ABCD Process. This roadmap fosters a purpose-driven approach, supporting professionals to handle complexity while nurturing hope and clarity, particularly through the A-Step’s visioning phase. Practitioners highlighted this step’s role in enhancing self-awareness, motivation, and emotional resilience, which assimilate with the capacities of KC7 mentioned by Ayers et al. (2023), and address the need for educational approaches to prepare students emotionally, not just intellectually, for sustainability work (Alvarez and Rogers 2006). On the other hand, the development of KC7 is not observed in the B-, C-, or D-Step from both experts and practitioners. A potential explanation for this overlook might be that reflections center on the A-Step’s visible emotional benefits, and the KC’s subtle role in later steps is overshadowed by other skills. Since the development of KC7 is not explicitly designed into the ABCD Process, its contributions in those steps were less apparent to both experts and practitioners. This gap aligns with Shephard et al. (2019) observation that KC7 (sometimes referred to as “collaborative competence” or “emotional competence”) is defined differently across contexts and often sidelined in traditional sustainability frameworks, where the emphasis typically lies on technical or strategic competencies rather than emotional resilience.

The lack of direct focus on intra-personal growth within the ABCD Process by design, as noted by both experts, aligned with practitioners’ observations that its development often feels like a side effect rather than a deliberate outcome. For sustainability professionals, the ABCD Process does offer a supportive environment for KC7, as it is a collaborative process utilized by teams, while its growth relies on external factors like facilitation quality, intention, and participant readiness. It is suggested that intentional integration by facilitators could better maximize the development of KC7 in practice if one seeks to further develop this competency. The contextual factors are discussed in further detail below (see section 5.2).

5.1.8 Integration Competency (KC8)

Table 5.8. Heatmap Comparison of Experts & Practitioners: Integration Competency.

	EXPERT	PRACTITIONER
ABCD Process		9
A-Step		1
B-Step		2
C-Step		3
D-Step		4

As presented in Table 5.8, experts and practitioners shared an agreement about the presence of KC8 within the ABCD Process, but with variations of views. Experts saw it as an overarching, challenging ability to self-reflect, develop, and be self-critical. E1 noted that KC8 developed continuously throughout the ABCD Process in an indirect manner, serving as a context for problem-solving and involving the integration of various competencies, resonating with Broman and Robèrt’s (2017) description of the ABCD Process as a collaborative, transdisciplinary approach that integrates diverse perspectives to navigate sustainability challenges. They emphasized its conceptual and dynamic nature with mentions in the A- and B-Step. Similarly, most practitioners also associated KC8 with the ABCD Process as a whole, with nine affirmations of its presence. However, there were no patterns identified regarding the development of this KC, with only singular views recorded, which illustrated the practitioners’

difficulty in clearly articulating its development across all steps. This can be explained by the insight that multiple practitioners found the definition of KC8 hard to grasp. Experts similarly described KC8 as “extremely challenging” to build up, requiring an understanding of frameworks, processes, and who to involve. This complexity echoes Wiek et al.’s (2011) assertion that sustainability competencies require a sophisticated problem-solving capacity that transcends traditional disciplinary boundaries. This understanding discrepancy also underscores the gap between the theoretical framing of the UFCAST and practitioners’ experiential perspectives, reflecting the challenge of understanding the development of KC8 in the ABCD Process.

KC8’s association with individual steps is not strongly evident, as there is only a slight increase in mentions across the steps (one in the A-Step, two in the B-Step, three in the C-Step, and four in the D-Step). Practitioners viewed KC8 as a product of the stepwise, iterative process that evolves through multiple rounds. Notably, three practitioners emphasized that its development relies on revisiting steps to incorporate new knowledge. Moreover, practitioners also noted that KC8 tends to develop more readily among facilitators of the ABCD Process than among participants, suggesting it is best acquired through sustained, hands-on engagement with strategic planning rather than through theoretical instruction or isolated strategic planning workshops.

Furthermore, practitioners’ insights into the interconnected development of KCs, such as the Planning Competencies (KC1, KC2, KC3, KC4), and the Key Professional Competencies (KC6, KC7), suggest that the ABCD Process may support a subtle form of integration as supported by Redman and Wiek’s (2021) framework where KCs are interdependent and need to be developed collaboratively to support sustainability problem-solving. Practitioners describe these competencies as dynamically interwoven across all steps. Similarly, experts view the KCs as an interconnected “package deal”, emphasizing their collective role rather than isolated development, which implies a potential, though indirect, presence of KC8. This suggests that the ABCD Process may enable KC8 to emerge implicitly through the interplay of other competencies, though its direct fostering remains subtle and was not strongly recognized. This observation is consistent with Wiek and Lang’s (2016) assertion that implementing transformational sustainability frameworks in professional contexts often results in the indirect development of KCs.

5.2 Overall Discussion ABCD Process & Key Competencies

Our research suggests that the ABCD Process serves as a scaffold that cultivates the development of all KCs, especially when implemented iteratively, contextually, and with skilled facilitation, aligning with Wiek et al.’s (2011) emphasis on sustainability competencies as problem-solving capacities developed through structured, participatory processes. The ABCD Process provides a container for competency emergence through structured participation, collaborative decision-making, and reflective learning. Both as individual steps and as a whole process, it offers opportunities for distinct KCs to surface and deepen. Specifically, the A-Step is a strong point for developing KCs that enable planning, particularly Systems Thinking, Futures Thinking, and Strategies Thinking, where both experts and practitioners saw significant connections. The visioning component of the A-Step appears to be a key driver for the development of these KCs.

A key pattern identified from both expert and practitioner perspectives is that the Planning Competencies, specifically Systems, Futures, Values, and Strategies Thinking, are strongly represented within individual ABCD steps, a finding consistent with Brundiens et al.'s (2021) mapping of the original KCs (Systems, Futures, Values, and Strategies Thinking, Interpersonal Competency) to specific stages of integrated sustainability problem-solving (see Appendix G). For example, our research indicates that Systems, Futures and Values Thinking are closely associated with the visioning and baseline analysis phases of the A-Step and B-Step, aligning with Brundiens et al.'s (2021) mapping. Additionally, the findings highlight that Strategies Thinking develops prominently during the D-Step, where decision-making and prioritization occur, though this differs slightly from Brundiens et al.'s mapping, which associates Strategies Thinking with both the C-Step and D-Step. In contrast, the Key Professional Competencies (Interpersonal and Intra-personal) and Integration Competency tend to emerge and strengthen across the ABCD Process as a whole, mirroring Brundiens et al.'s observation that Interpersonal Competency develops throughout all process steps. However, Implementation Competency remains contentious, as noted earlier in the discussion, which aligns with Brundiens et al.'s view that emerging competencies (Implementation, Intra-personal, Integration) are interdependent and often cultivated holistically rather than being tied to specific steps (Ibid).

The research also shows that the way the ABCD Process is implemented significantly affects the degree to which KCs are developed, a finding supported by Osagie et al.'s (2016) argument that competency development in professional settings is influenced by contextual and process-related factors. Three key factors emerged:

1. **Iterations of the ABCD Process:** The more extended and iterative engagement with the ABCD Process is, the deeper the KCs get developed. A six-hour session offers an initial awareness, while year-long iterations of the ABCD steps foster reflection, feedback, and adaptive planning which leads to depth of KC development. Exemplary, P6 underlaid, *“Now, [after A- and B-Step], I understand this is where we are and this is where we're aiming. And now I see how that plays together, and then we move into the C-Step and the D-Step, and then you have one complete round. Then you're able to go back [...] to the A-Step and deepening that knowledge once more”*.
2. **Facilitation and intention:** Skilled facilitators play an important role in creating learning conditions and making the process smoother, echoing Wiek and Lang's (2016) call for intentional facilitation to operationalize transformational sustainability frameworks. *“The quality of the intervention [ABCD Process] is directly proportional to the quality [of] the internal conditions of the intervener”*, shared P12, emphasizing this key factor. When facilitators are aware of the KCs, they can design the process to intentionally support their emergence, e.g., by encouraging participant reflection, fostering inclusive and meaningful dialogue, managing power dynamics, or using tools that support KC's comprehension. Furthermore, the technical knowledge of the facilitator in the respective industry was mentioned as a contextual factor, as well as the ability of the facilitator to bring the right people into the room and foster trust among ABCD Process participants.
3. **Organizational mindset:** The *“culture within the organization, the size, [and] the availability of people”* (P14) strongly influences how the development of the KCs unfolds, regardless of the ABCD Process. This is reinforced by Osagie et al.'s (2016) observation that organizational factors and stakeholder engagement shape competency outcomes. Some competencies, such as Strategies Thinking or Intra- and Interpersonal Competencies, may not develop if short-term goals, rigid hierarchies, or little availability of the participants are in place.

Based on these findings, we outline several enabling conditions necessary for the development of KCs in professional contexts. These recommendations aim to provide guidance for our target group of practitioners and stakeholders in creating these conditions while trying to translate the implications of the research into practice:

1. **Secure long-term engagement with the ABCD Process:** A long-term engagement, enabling iterative application of the ABCD Process, allows for reflection, learning loops, and adaptive planning which enhances the development of KCs.
2. **Work with skilled and credible facilitators:** Skilled facilitators in strategic leadership towards sustainability can create conditions for inclusive dialogue and reflective team practices that foster the development of KCs.
3. **Provide mandate and multi-stakeholder involvement:** Motivation and mandate for long-term sustainability work, including management commitment, serve as foundational conditions for growing the development of KCs. Moreover, an organizational environment that values collaboration and supports multi-stakeholder participation creates further conditions for KCs growth.

Furthermore, despite the diverse backgrounds of the interviewed practitioners, no pattern emerged regarding the influence of their diversity on the application of the ABCD Process or the development of KCs. Factors such as the country of practice, the sector of work, or where they learned about the ABCD Process did not appear to affect how practitioners applied the ABCD Process, suggesting that its impact on the development of KCs may be relatively consistent across diverse professional contexts.

Directly addressing the research question, this study finds that the ABCD Process provides a structured yet adaptable framework that partially bridges the gap between academia and professional settings. It supports a varied and context-dependent development of KCs in sustainability, both in step-specific and holistic ways. The outcomes are shaped by how the process is applied, the context in which it is used, and the intentionality of its implementation. Practitioners showed patterns of applying competencies such as Systems, Futures, and Values Thinking in the A-Step, and Strategies Thinking in the D-Step, to navigate real-world complexities. Interpersonal and Intra-personal tend to emerge more organically through collaborative interactions, while Implementation Competency shows limited development, likely due to the ABCD Process's planning-oriented nature. Integration appears to evolve gradually through iterative engagement. The process' iterative nature fosters reflective learning and adaptability, facilitating the gradual translation of theoretical concepts into practice. This supports Brundiens et al. (2021) emphasis on the importance of integrated sustainability problem-solving. However, the limited and conditional emergence of Implementation Competency suggests a lingering gap between academic and professional contexts. Overall, the findings affirm that the KCs are not developed in isolation but co-evolve in mutually reinforcing ways. This is consistent with Redman and Wiek's (2021) perspective on the interconnectedness of sustainability competencies. These patterns mirror Brundiens et al.'s (2021) findings on the uneven but contextual activation of KCs in professional practice.

5.3 Limitations and Further Research

While this study has provided insights into how the ABCD Process facilitates the development of KCs in professional practice, it is important to acknowledge the limitations of the research and consider avenues for future investigation.

The deductive approach adopted in this study, driven by time constraints, shaped interviews around the predefined ABCD Process and the UFCAST. This potentially limited inductive insights and deeper reflections of practitioners on unanticipated themes. Time limitations also restricted the number and diversity of interviews, potentially weakening the study's representativeness. Future research could strengthen the findings by conducting additional interviews with a broader range of practitioners. Moreover, although patterns were observed in the development of specific KCs in facilitators and participants through the ABCD Process, the corresponding interview questions were not asked across all participants. This might be because the interview flow was tested in only a single pilot session before data collection due to time constraints. Future research could address this limitation by conducting multiple pilot interviews to refine the question set and ensure comprehensive coverage of relevant themes. Additionally, time constraints also limited the scope of the literature review, potentially affecting the theoretical depth and contextual grounding of the analysis. Expanding the literature review in future studies would enhance the conceptual rigor and strengthen the overall analytical framework.

Practitioners' high-level understanding of KCs, due to brief introductions, contrasted with experts' deeper knowledge, potentially reducing the depth of discussions on competency engagement in practice. Additionally, the interview structure often prioritized Systems Thinking early in discussions, while Integration Competency was typically addressed last, which may have resulted in more data collected on earlier-discussed competencies like Systems Thinking compared to later ones like Integration Competency. To address these issues in future research, conducting longer interviews with more detailed explanations of KCs and providing participants with comprehensive preparatory materials in advance could improve the clarity and quality of explanations, potentially fostering richer and more balanced discussions across all competencies.

The result of Phase 2 revealed 18 distinct interpretations of the ABCD Process (see Appendix H), highlighting its context-specific adaptations. These diverged from the theoretical framework used in Phase 1 for analysis, challenging the comparability of how KCs develop across contexts.

The study relied on practitioners' self-reported perceptions of the development of KCs, rather than objective assessments. This may limit the accuracy of the findings. For example, objective measures like performance-based tests (e.g., applying systems thinking to real-world sustainability case studies) or 360-degree feedback on collaborative skills could provide a more accurate gauge of competency development. Moreover, the development of KCs is inherently difficult to measure (see below), raising the possibility that practitioners may have developed certain KCs not solely due to the ABCD Process but through other professional activities they engage in, further complicating the attribution of competency growth.

Future research could explore refining the ABCD Process to enhance its capacity to develop KCs in professional practice through a transdisciplinary approach, meaning collaborating with practitioners to design and test modifications that strengthen the integration of KCs while preserving the process's core structure. Especially regarding Implementation Competency, further research could analyze the described findings in detail and provide answers, e.g., including prototyping as a tool in the ABCD Process. This is in line with the academic discourse in SSD where iterative refinement of the ABCD Process and its application in collaboration

with practitioners has been explored to strengthen its relevance in professional practice while maintaining its own structure (Wälitalo et al. 2020; França et al. 2017).

Regarding the discourse on the UFCAST, validating the framework in other professional settings will help to understand if the KCs are supporting sustainability leaders in creating lasting solutions. Specifically, research on other strategic problem-solving approaches and their development of KCs can be undertaken, adding to the work of Brundiens et al. (2021) and Redman and Wiek (2021).

Another potential approach lies in advancing KCs assessment methods, as current tools lack standardization, complicating transitions from education to practice (Redman 2020; Scherak and Rieckmann 2022). As seen throughout the interviews, assessments remain underdeveloped, relying on varied tools like self-perception, observation, and tests, often applied inconsistently due to unclear guidance. Integrating assessments into the learning journey, covering planning, implementation, reflection, and re-planning could better align academic training with professional demands, improving competency measurement and application in strategic frameworks like the ABCD Process (Giangrande et al. 2019).

6 Conclusion

This research explored how the ABCD Process facilitates the development of key competencies in sustainability within professional practice. Through conceptual mapping based on academic literature, expert insights, and practitioner experiences, we found that the ABCD Process supports the development of KCs in varying and context-specific ways, with Planning Competencies more clearly linked to individual ABCD steps, and other competencies, like Interpersonal, Intrapersonal, and Integration, emerging more holistically across the process. However, Implementation Competency remains a challenge, often requiring additional structures beyond what the process currently offers. The findings indicate that the ABCD Process can act as both a structural and adaptive planning framework, enabling the development of KCs when applied iteratively, and with skilled facilitation. For example, the A-Step was shown to strongly support Systems, Futures, and Values Thinking, while the D-Step emerged as a key space for Strategies Thinking.

Three key conditions were identified as critical to the ABCD Process' effectiveness: the duration and repetition of its application, the intentionality and capability of its facilitators, and the organizational mindset in which it is embedded. When these factors are adequately fulfilled, the ABCD Process is more likely to foster the development of KCs and contribute meaningfully to strategic sustainability transitions.

By exploring the connections between the KCs and the ABCD Process in use, this research contributes to bridging the often-discussed gap between academic competency frameworks and real-world sustainability practice. It highlights how strategic planning tools such as the ABCD Process can help operationalize KCs through collaboration, participatory dialogue, and critical reflection. Furthermore, the research affirms the value of structured, strategic, and participatory processes, like the ABCD Process, as an environment where KCs can be developed and practiced. This shows how the ABCD Process, rooted in SSD and the FSSD, can guide both planning and learning towards sustainability. In doing so, this study aligns with the aim of sustainability science to generate use-inspired knowledge that links understanding to action, integrates normative and systems perspectives, and supports transitions toward sustainability in context-specific ways.

While the ABCD Process is not a comprehensive tool for all aspects of KC development, it provides a strategic entry point that can be strengthened through contextual adaptations and greater awareness of how KCs emerge in practice. We hope these insights contribute to ongoing efforts to bridge the academic-professional gap in sustainability work and inform the more intentional design of tools, strategies, and learning environments that support the next generation of sustainability professionals.

7 References

- Edelman. 2025. “2025 Edelman Trust Barometer.” 2025. <https://www.edelman.com/trust/2025/trust-barometer>.
- Accenture. 2010. “A New Era of Sustainability – UN Global Compact-Accenture CEO Study 2010 | UN Global Compact.” 2010. <https://unglobalcompact.org/library/230>.
- Adams, William C. 2015. “Conducting Semi-Structured Interviews.” In *Handbook of Practical Program Evaluation*, edited by Kathryn E. Newcomer, Harry P. Hatry, and Joseph S. Wholey, 1st ed., 492–505. Wiley. <https://doi.org/10.1002/9781119171386.ch19>.
- Alvarez, A., and J. Rogers. 2006. “Going ‘out There’: Learning about Sustainability in Place.” *International Journal of Sustainability in Higher Education* 7, no. 2: 176–88. <https://doi.org/10.1108/14676370610655940>.
- Ayers, James, Merlina Missimer, and Jayne Bryant. 2023. “Intrapersonal Capacities for Sustainability: A Change Agent Perspective on the ‘Inner Dimension’ of Sustainability Work.” *Sustainability Science* 18, no. 3 (May): 1181–97. <https://doi.org/10.1007/s11625-022-01288-8>.
- Baas, Jeroen, Michiel Schotten, Andrew Plume, Grégoire Côté, and Reza Karimi. 2020. “Scopus as a Curated, High-Quality Bibliometric Data Source for Academic Research in Quantitative Science Studies.” *Quantitative Science Studies* 1, no. 1 (February): 377–86. https://doi.org/10.1162/qss_a_00019.
- Baumgartner, R.J., and J. Korhonen. 2010. “Strategic Thinking for Sustainable Development.” *Sustainable Development* 18, no. 2: 71–75. <https://doi.org/10.1002/sd.452>.
- Baumgartner, Rupert J., and Romana Rauter. 2017. “Strategic Perspectives of Corporate Sustainability Management to Develop a Sustainable Organization.” *Journal of Cleaner Production*, Systematic Leadership towards Sustainability, 140, no. January (January): 81–92. <https://doi.org/10.1016/j.jclepro.2016.04.146>.
- Birt, Linda, Suzanne Scott, Debbie Cavers, Christine Campbell, and Fiona Walter. 2016. “Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation?” *Qualitative Health Research* 26, no. 13 (November): 1802–11. <https://doi.org/10.1177/1049732316654870>.
- Broman, G.I., and K.-H. Robèrt. 2025. “Operative System for Strategic Sustainable Development—Coordinating Analysis, Planning, Action, and Use of Supports Such as the Sustainable Development Goals, Planetary Boundaries, Circular Economy, and Science-Based Targets.” *Sustainable Development*. <https://doi.org/10.1002/sd.3357>.
- Broman, Göran Ingvar, and Karl-Henrik Robèrt. 2017. “A Framework for Strategic Sustainable Development.” *Journal of Cleaner Production*, Systematic Leadership towards Sustainability, 140, no. January (January): 17–31. <https://doi.org/10.1016/j.jclepro.2015.10.121>.
- Brundiers, Katja, Matthias Barth, Gisela Cebrián, Matthew Cohen, Liliana Diaz, Sonya Doucette-Remington, Weston Dripps, et al. 2021. “Key Competencies in Sustainability in Higher Education—toward an Agreed-upon Reference Framework.” *Sustainability Science* 16, no. 1 (January): 13–29. <https://doi.org/10.1007/s11625-020-00838-2>.
- Calvin, Katherine, Dipak Dasgupta, Gerhard Krinner, Aditi Mukherji, Peter W. Thorne, Christopher Trisos, José Romero, et al. 2023. “IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (Eds.)]. IPCC, Geneva, Switzerland.” First. Intergovernmental Panel on Climate Change (IPCC). <https://doi.org/10.59327/IPCC/AR6-9789291691647>.

- Chen, K.-H., and L.-P. Hsu. 2020. "Visioning the Future: Evaluating Learning Outcomes and Impacts of Futures-Oriented Education." *Journal of Futures Studies* 24, no. 4: 103–6. [https://doi.org/10.6531/JFS.202006_24\(4\).0011](https://doi.org/10.6531/JFS.202006_24(4).0011).
- Crick, Ruth Deakin. 2008. "Key Competencies for Education in a European Context: Narratives of Accountability or Care." *European Educational Research Journal* 7, no. 3 (September): 311–18. <https://doi.org/10.2304/eeerj.2008.7.3.311>.
- Eisenmenger, N., M. Pichler, N. Krenmayr, D. Noll, B. Plank, E. Schalmann, M.-T. Wandl, and S. Gingrich. 2020. "The Sustainable Development Goals Prioritize Economic Growth over Sustainable Resource Use: A Critical Reflection on the SDGs from a Socio-Ecological Perspective." *Sustainability Science* 15, no. 4: 1101–10. <https://doi.org/10.1007/s11625-020-00813-x>.
- Fang, X., B. Zhou, X. Tu, Q. Ma, and J. Wu. 2018. "What Kind of a Science Is Sustainability Science? An Evidence-Based Reexamination." *Sustainability (Switzerland)* 10, no. 5. <https://doi.org/10.3390/su10051478>.
- Foucrier, Tamsin, and Arnim Wiek. 2019. "Adoption of the Key Competencies in Sustainability in Programs and Courses around the World." Arizona State University, Tempe.
- França, C.L., G. Broman, K.-H. Robèrt, G. Basile, and L. Trygg. 2017. "An Approach to Business Model Innovation and Design for Strategic Sustainable Development." *Journal of Cleaner Production* 140: 155–66. <https://doi.org/10.1016/j.jclepro.2016.06.124>.
- Frank, P. 2021. "A Proposal of Personal Competencies for Sustainable Consumption." *International Journal of Sustainability in Higher Education* 22, no. 6: 1225–45. <https://doi.org/10.1108/IJSHE-01-2020-0027>.
- Fry, Louis W., and Eleftheria Egel. 2021. "Global Leadership for Sustainability." *Sustainability* 13, no. 11 (January): 6360. <https://doi.org/10.3390/su13116360>.
- Giangrande, Naresh, Rehema M. White, May East, Ross Jackson, Tim Clarke, Michel Saloff Coste, and Gil Penha-Lopes. 2019. "A Competency Framework to Assess and Activate Education for Sustainable Development: Addressing the UN Sustainable Development Goals 4.7 Challenge." *Sustainability* 11, no. 10 (January): 2832. <https://doi.org/10.3390/su11102832>.
- Gill, P., K. Stewart, E. Treasure, and B. Chadwick. 2008. "Methods of Data Collection in Qualitative Research: Interviews and Focus Groups." *British Dental Journal* 204, no. 6 (March): 291–95. <https://doi.org/10.1038/bdj.2008.192>.
- Glavič, P., and R. Lukman. 2007. "Review of Sustainability Terms and Their Definitions." *Journal of Cleaner Production* 15, no. 18: 1875–85. <https://doi.org/10.1016/j.jclepro.2006.12.006>.
- Golafshani, Nahid. 2015. "Understanding Reliability and Validity in Qualitative Research." *The Qualitative Report*, January (January). <https://doi.org/10.46743/2160-3715/2003.1870>.
- Gómez-Olmedo, A.M., C. Valor, and I. Carrero. 2020. "Mindfulness in Education for Sustainable Development to Nurture Socioemotional Competencies: A Systematic Review and Meta-Analysis." *Environmental Education Research* 26, no. 11: 1527–55. <https://doi.org/10.1080/13504622.2020.1777264>.
- Grosseck, Gabriela, Laurențiu Gabriel Țiru, and Ramona Alice Bran. 2019. "Education for Sustainable Development: Evolution and Perspectives: A Bibliometric Review of Research, 1992–2018." *Sustainability* 11, no. 21 (January): 6136. <https://doi.org/10.3390/su11216136>.
- Guest, Greg, Arwen Bunce, and Laura Johnson. 2006. "How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability." *Field Methods* 18, no. 1 (February): 59–82. <https://doi.org/10.1177/1525822X05279903>.

- Guido, Anthony, H. Farzaneh, and Jing-xuan Guo. 2012. "Social Actions of Strategic Sustainable Development." <https://consensus.app/papers/social-actions-of-strategic-sustainable-development-guido-farzaneh/f11fd920ca4c561e826662acb5d94de3/>.
- Gulikers, J.T.M., T.J. Bastiaens, P.A. Kirschner, and L. Kester. 2008. "Authenticity Is in the Eye of the Beholder: Student and Teacher Perceptions of Assessment Authenticity." *Journal of Vocational Education and Training* 60, no. 4: 401–12. <https://doi.org/10.1080/13636820802591830>.
- Hill, Clara E., Sarah Knox, Barbara J. Thompson, Elizabeth Nutt Williams, Shirley A. Hess, and Nicholas Ladany. 2005. "Consensual Qualitative Research: An Update." *Journal of Counseling Psychology* 52, no. 2 (April): 196–205. <https://doi.org/10.1037/0022-0167.52.2.196>.
- IPBES. 2019. "Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services." Zenodo. <https://doi.org/10.5281/zenodo.3553579>.
- Kajikawa, Yuya, Francisco Taco, and Kiyohiro Yamaguchi. 2014. "Sustainability Science: The Changing Landscape of Sustainability Research." *Sustainability Science* 9, no. 4 (October): 431–38. <https://doi.org/10.1007/s11625-014-0244-x>.
- Kanie, N., and F. Biermann. 2017. *Governing through Goals: Sustainable Development Goals as Governance Innovation*. Governing Through Goals: Sustainable Development Goals as Governance Innovation.
- Kates, Robert W. 2016. "Sustainability Science." In *International Encyclopedia of Geography*, 1–4. John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118786352.wbieg0279>.
- Kates, R.W., W.C. Clark, R. Corell, J.M. Hall, C.C. Jaeger, I. Lowe, J.J. McCarthy, et al. 2001. "Environment and Development: Sustainability Science." *Science* 292, no. 5517: 641–42. <https://doi.org/10.1126/science.1059386>.
- Khalili, N.R., and W. Melaragno. 2011. "Strategic Tools for Achieving Long-Term Sustainability." In *Practical Sustainability: From Grounded Theory to Emerging Strategies*, 23–55. <https://doi.org/10.1057/9780230116368>.
- Korstjens, Irene, and Albine and Moser. 2018. "Series: Practical Guidance to Qualitative Research. Part 4: Trustworthiness and Publishing." *European Journal of General Practice* 24, no. 1 (January): 120–24. <https://doi.org/10.1080/13814788.2017.1375092>.
- Kroll, C., A. Warchold, and P. Pradhan. 2019. "Sustainable Development Goals (SDGs): Are We Successful in Turning Trade-Offs into Synergies?" *Palgrave Communications* 5, no. 1. <https://doi.org/10.1057/s41599-019-0335-5>.
- Lang, Daniel J., Arnim Wiek, Matthias Bergmann, Michael Stauffacher, Pim Martens, Peter Moll, Mark Swilling, and Christopher J. Thomas. 2012. "Transdisciplinary Research in Sustainability Science: Practice, Principles, and Challenges." *Sustainability Science* 7, no. 1 (February): 25–43. <https://doi.org/10.1007/s11625-011-0149-x>.
- Lans, Thomas, Vincent Blok, and Renate Wesselink. 2014. "Learning Apart and Together: Towards an Integrated Competence Framework for Sustainable Entrepreneurship in Higher Education." *Journal of Cleaner Production*, Higher Education for Sustainable Development: Emerging Areas, 62, no. January (January): 37–47. <https://doi.org/10.1016/j.jclepro.2013.03.036>.
- Liu, J., T. Dietz, S.R. Carpenter, M. Alberti, C. Folke, E. Moran, A.N. Pell, et al. 2007. "Complexity of Coupled Human and Natural Systems." *Science* 317, no. 5844: 1513–16. <https://doi.org/10.1126/science.1144004>.
- Liu, J., H. Mooney, V. Hull, S.J. Davis, J. Gaskell, T. Hertel, J. Lubchenco, et al. 2015. "Systems Integration for Global Sustainability." *Science* 347, no. 6225. <https://doi.org/10.1126/science.1258832>.
- Loiseau, E., L. Saikku, R. Antikainen, N. Droste, B. Hansjürgens, K. Pitkänen, P. Leskinen, P. Kuikman, and M. Thomsen. 2016. "Green Economy and Related Concepts: An

- Overview.” *Journal of Cleaner Production* 139: 361–71. <https://doi.org/10.1016/j.jclepro.2016.08.024>.
- Lozano, R., R. Lukman, F.J. Lozano, D. Huisingh, and W. Lambrechts. 2013. “Declarations for Sustainability in Higher Education: Becoming Better Leaders, through Addressing the University System.” *Journal of Cleaner Production* 48: 10–19. <https://doi.org/10.1016/j.jclepro.2011.10.006>.
- Maxwell, Joseph A. 2012. *Qualitative Research Design: An Interactive Approach*. SAGE Publications.
- Metcalf, L., and S. Benn. 2013. “Leadership for Sustainability: An Evolution of Leadership Ability.” *Journal of Business Ethics* 112, no. 3: 369–84. <https://doi.org/10.1007/s10551-012-1278-6>.
- Miller, Thaddeus R. 2013. “Constructing Sustainability Science: Emerging Perspectives and Research Trajectories.” *Sustainability Science* 8, no. 2 (April): 279–93. <https://doi.org/10.1007/s11625-012-0180-6>.
- Missimer, Merlina, Karl-Henrik Robèrt, and Göran Broman. 2017. “A Strategic Approach to Social Sustainability – Part 1: Exploring the Social System.” *Journal of Cleaner Production* 140, no. January (January): 32–41. <https://doi.org/10.1016/j.jclepro.2016.03.170>.
- Naeem, Muhammad, Wilson Ozuem, Kerry Howell, and Silvia Ranfagni. 2023. “A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research.” *International Journal of Qualitative Methods* 22, no. October (October). <https://doi.org/10.1177/16094069231205789>.
- Nagatsu, Michiru, Taylor Davis, C. Tyler DesRoches, Inkeri Koskinen, Miles MacLeod, Milutin Stojanovic, and Henrik Thorén. 2020. “Philosophy of Science for Sustainability Science.” *Sustainability Science* 15, no. 6 (November): 1807–17. <https://doi.org/10.1007/s11625-020-00832-8>.
- Naudé, M. 2014. “Strategic Thinking To Enhance Sustainable Development: A Proposed Framework.” <https://consensus.app/papers/strategic-thinking-to-enhance-sustainable-development-a-naud%C3%A9/412b0d57083d5965ac5abe19829cc5ac/>.
- Ngo, Thang Loi, Quoc Dung Ngo, and Manh Dung Tran. 2019. “Sustainable Development of Enterprises: Barriers and Policy Recommendations.” *Journal of Economics and Sustainable Development* 10, no. 16: 90.
- Nilsson, M., E. Chisholm, D. Griggs, P. Howden-Chapman, D. McCollum, P. Messerli, B. Neumann, A.-S. Stevance, M. Visbeck, and M. Stafford-Smith. 2018. “Mapping Interactions between the Sustainable Development Goals: Lessons Learned and Ways Forward.” *Sustainability Science* 13, no. 6: 1489–1503. <https://doi.org/10.1007/s11625-018-0604-z>.
- Osagie, E. R., R. Wesselink, V. Blok, T. Lans, and M. Mulder. 2016. “Individual Competencies for Corporate Social Responsibility: A Literature and Practice Perspective.” *Journal of Business Ethics* 135, no. 2 (May): 233–52. <https://doi.org/10.1007/s10551-014-2469-0>.
- Patton, Michael Quinn. 2015. *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. Fourth edition. Los Angeles London New Delhi Singapore Washington DC: SAGE.
- Redclift, M. 2005. “Sustainable Development (1987-2005): An Oxymoron Comes of Age.” *Sustainable Development* 13, no. 4: 212–27. <https://doi.org/10.1002/sd.281>.
- Redman, Aaron. 2020. “Assessing the Development of Key Competencies in Sustainability.” Arizona State University. <https://keep.lib.asu.edu/items/158565>.
- Redman, Aaron, and Arnim Wiek. 2021. “Competencies for Advancing Transformations Towards Sustainability.” *Frontiers in Education* 6, no. November (November): 785163. <https://doi.org/10.3389/feduc.2021.785163>.

- Rittel, Horst W. J., and Melvin M. Webber. 1973. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4, no. 2 (June): 155–69. <https://doi.org/10.1007/BF01405730>.
- Robèrt, K.-H., B. Schmidt-Bleek, J. Aloisi De Larderel, G. Basile, J.L. Jansen, R. Kuehr, P. Price Thomas, M. Suzuki, P. Hawken, and M. Wackernagel. 2002. "Strategic Sustainable Development - Selection, Design and Synergies of Applied Tools." *Journal of Cleaner Production* 10, no. 3: 197–214. [https://doi.org/10.1016/S0959-6526\(01\)00061-0](https://doi.org/10.1016/S0959-6526(01)00061-0).
- Rockström, J., W. Steffen, K. Noone, Å. Persson, F.S. Chapin, E.F. Lambin, T.M. Lenton, et al. 2009. "A Safe Operating Space for Humanity." *Nature* 461, no. 7263: 472–75. <https://doi.org/10.1038/461472a>.
- Roe, R.A. 2000. "What Makes a Competent Psychologist?" *European Psychologist* 7, no. 3: 192–202.
- Sachs, J.D. 2013. "High Stakes at the Un on the Sustainable Development Goals." *The Lancet* 382, no. 9897: 1001–2. [https://doi.org/10.1016/S0140-6736\(13\)61956-X](https://doi.org/10.1016/S0140-6736(13)61956-X).
- Sajjad, A., G. Eweje, and M.M. Raziq. 2024. "Sustainability Leadership: An Integrative Review and Conceptual Synthesis." *Business Strategy and the Environment* 33, no. 4: 2849–67. <https://doi.org/10.1002/bse.3631>.
- Scherak, Lukas, and Marco Rieckmann. 2022. "Development and Assessment of ESD Competences: Staff Training at the University of Vechta." In *Competences in Education for Sustainable Development: Critical Perspectives*, edited by Paul Vare, Nadia Lousselet, and Marco Rieckmann, 121–28. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-91055-6_15.
- Shapira, H., A. Ketchie, and M. Nehe. 2017. "The Integration of Design Thinking and Strategic Sustainable Development." *Journal of Cleaner Production* 140: 277–87. <https://doi.org/10.1016/j.jclepro.2015.10.092>.
- Shephard, K. 2008. "Higher Education for Sustainability: Seeking Affective Learning Outcomes." *International Journal of Sustainability in Higher Education* 9, no. 1: 87–98. <https://doi.org/10.1108/14676370810842201>.
- Shephard, K., M. Rieckmann, and M. Barth. 2019. "Seeking Sustainability Competence and Capability in the ESD and HESD Literature: An International Philosophical Hermeneutic Analysis." *Environmental Education Research* 25, no. 4: 532–47. <https://doi.org/10.1080/13504622.2018.1490947>.
- Steffen, W., K. Richardson, J. Rockström, S.E. Cornell, I. Fetzer, E.M. Bennett, R. Biggs, et al. 2015. "Planetary Boundaries: Guiding Human Development on a Changing Planet." *Science* 347, no. 6223. <https://doi.org/10.1126/science.1259855>.
- Tejedor, Gemma, Jordi Segalàs, Àngela Barrón, Mónica Fernández-Morilla, M. Teresa Fuertes, Jorge Ruiz-Morales, Ibón Gutiérrez, Esther García-González, Pilar Aramburuzabala, and Àngels Hernández. 2019. "Didactic Strategies to Promote Competencies in Sustainability." *Sustainability* 11, no. 7 (April): 2086. <https://doi.org/10.3390/su11072086>.
- UNESCO. 2020. "Education for Sustainable Development: A Roadmap." UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000374802?posInSet=2&queryId=a2c9f83b-44cc-413a-a283-e48884ddcaa3>.
- United Nations. 1992. "Education Commitments Agenda 21—Chapter 36 & UN Commission on Sustainable Development." 1992. https://www.iatp.org/sites/default/files/Education_Commitments_-_Agenda_21_Chapter_36.htm.
- Wälitalo, Lisa, Karl-Henrik Robèrt, and Göran Broman. 2020. "An Overarching Model for Cross-Sector Strategic Transitions towards Sustainability in Municipalities and

- Regions.” *Sustainability* 12, no. 17 (January): 7046. <https://doi.org/10.3390/su12177046>.
- Wals, A.E.J., and B. Jickling. 2002. “‘Sustainability’ in Higher Education: From Doublethink and Newspeak to Critical Thinking and Meaningful Learning.” *International Journal of Sustainability in Higher Education* 3, no. 3: 221–32. <https://doi.org/10.1108/14676370210434688>.
- Wiek, Arnim, and Daniel J. Lang. 2016. “Transformational Sustainability Research Methodology.” In *Sustainability Science: An Introduction*, edited by Harald Heinrichs, Pim Martens, Gerd Michelsen, and Arnim Wiek, 31–41. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-017-7242-6_3.
- Wiek, Arnim, Lauren Withycombe, and Charles L. Redman. 2011. “Key Competencies in Sustainability: A Reference Framework for Academic Program Development.” *Sustainability Science* 6, no. 2 (July): 203–18. <https://doi.org/10.1007/s11625-011-0132-6>.
- World Commission On Environment And Development. 1987. “Report of the World Commission on Environment and Development:” Our Common Future. 1987. <http://www.un-documents.net/wced-ocf.htm>.
- Mochizuki, Yoko. 2016. “Educating for Transforming Our World: Revisiting International Debates Surrounding Education for Sustainable Development.” *Current Issues in Comparative Education* 19, no. 1 (January). <https://doi.org/10.52214/cice.v19i1.11538>.

8 Appendices

Appendix A: Search Terms for Conceptual Mapping using Academic Literature

- For the ABCD Process:
 - o (TITLE-ABS-KEY (backcasting) AND TITLE-ABS-KEY ("strategic sustainable development")) AND PUBYEAR > 1999
 - o (TITLE-ABS-KEY ("strategic sustainable development") AND REF (broman)) AND PUBYEAR > 1999

- For the Key Competencies in sustainability:
 - o Title (competenc* AND sustain*) OR keywords (competenc* AND sustain*) AND ref (wiek) AND publishing year > 2010 AND excluding (SUB AREA,"MEDI") AND limiting to (LANGUAGE,"English").

Appendix B: Preparatory Conceptual Mapping using Academic Literature

Legend: alignment - green, non-alignment - red

KC	KC1	KC2	KC3	KC4	KC5	KC6	KC7	KC8
ABCD Process	Having systems thinking perspective in whole ABCD (incl. intersystem / nested view).		SPs as central value for definition of sustainability.	Th whole ABCD is a tool to develop a strategy.	Implementing whole ABCD will help you develop implementation competency.	I would say it runs throughout the entire process for an individual facilitation.	ABCD as a whole is an intense process which requires working with loads of information (collecting, analyzing), in time constraints and with diversity of individuals (different opinions, world views, needs, etc.). It requires to have resilience and self-awareness, discipline to carry the process out.	ABCD as a whole helps to integrate problem-solving procedures.
			Values can be different.		Limited to planning in decision phase; lacks focus on hands-on execution, potentially missing practical application skills.		The ABCD Process offers no tool to e.g., prevent burnout or self-reflect on personal development. Its a long and intense process which requires a lot of work.	
A-Step	The step potentially has individuals understanding the FSSD / Systems Thinking Beforehand or during the beginning phase.	The step requires to look to envisioned futures within boundary constraints.	The step requires an individual to understand and comprehend SP's and other values of a sustainable society.	To define BHAGs and even more short-term goals.		To involve various stakeholders and collaborate with them.	Being clear about own values as they are a base for organizational values.	Potential match.
		Partial mismatch: vision in ABCD is only within SPs, not open for another definition of success/vision in e.g., a new paradigm (something more than "not unsustainable").					Focuses on collective organizational understanding but does not encourage individual self-reflection or personal alignment with sustainability principles.	
B-Step	Analytical competence as part of systems thinking competence. We examine both the external systems relations, to determine how the bigger system is organized. Then 1) we relate how the organization we are strategizing for is related to this bigger system and 2) how it's own operations are organized and related to other societal systems (supplies, community, etc.).	Potentially, with the idea that people are basing current actions on future understanding of the constraints of a sustainable society.	Analysis of organizational values might help develop this competency.			Potential match.	Potential match.	Integrate summary of many analyses and understand the problem integrated.
		The Baseline phase is diagnostic, focusing on the						

		current state rather than projecting future trends or scenarios. Futures thinking requires anticipating long-term shifts, which this phase does not address.						
C-Step	Think of ideas that are not only important for the organization itself but also for the whole system.	The brainstorming rids of constraints in time horizon and current systems obstacles.	We set up the brainstorming already to fit within the FSSD as a main value for moving towards sustainability.			In this step we may want to invite diverse voices and stakeholders to help the organization brainstorm more and more relevant, needed, desired solutions.	Bringing in your own sustainability values as they are a base for navigating the brainstorming process.	Be able to brainstorm ideas for all solutions, integrating different spaces.
						Although participation is emphasized, the process doesn't address the emotional or psychological aspects of collaboration, such as empathy, conflict resolution, or managing power dynamics, key elements of interpersonal competence.		
D-Step		Potentially if further prioritizations are used (e.g., urgency, uncertainty, and others).		Allows for prioritization and testing of feasibility and other factors.	It is related to both integration and implementation - this is the step where the ideas and plans are prioritized, the first step for putting into actually implementation and integration.			It is related to both integration and implementation - this is the step where the ideas and plans are prioritized, the first step for putting into actually implementation and integration.
				Mismatch: strategic thinking and prioritization for ABCD is not equal as defined in the KC definition.		Collaborative planning is highlighted, but the phase doesn't emphasize managing group dynamics during prioritization (e.g., resolving disagreements over timelines or resources).		
Action Plan	It helps analyze the actions plans and view them as how they would make a change to the system and/or solve a problem.			Action plan is part of competence. (Design, create, develop, test).	It is related to both integration and implementation - this is the step where the ideas and plans are put into action, including having distributed resources, accountable people, being monitored and adjusted.			It is related to both integration and implementation - this is the step where the ideas and plans are put into action, including having distributed resources, accountable people, being monitored and adjusted.

Appendix C: Semi-Structured Interview Flow for Interviews with Experts

- **Introduction:** Welcoming words and GDPR requirements. The interviews began with an open-ended question inviting each expert to reflect on how their respective theoretical framework is or can be translated into practice.
- **Key Competency Application Questions:**
 - o E1 was asked how they see the Key Competencies being applied in professional sustainability practice and what tools or strategies are required to cultivate them.
 - o E2 was asked whether they believe the ABCD Process facilitates the development of sustainability competencies.
- **Framework Mapping:**
 - o E1 was shown a preliminary mapping of the Key Competencies against the ABCD steps. We guided their feedback by going through each ABCD step and asking which Key Competency or Key Competencies could be developed through it.
 - o E2 was shown the same mapping, but the discussion was reversed, as we examined each Key Competency individually and asked in which ABCD step it could be most effectively developed.
- **Reflective Quote Analysis:** Both experts were presented with selected quotes from practitioner interviews. They were asked to reflect on the content of these quotes to provide additional interpretive depth and context based on their respective frameworks and knowledge.
- **Closing:** The interviewees were thanked for their time and answers.

Appendix D: Demographic of 14 Practitioner Interviewees

#	How did you first learn about the ABCD Process?	In which country have you most worked in?	How many years of experience do you have?	In which sectors do you apply the ABCD Process?
P1	As a student or alumni of the Master's of Strategic Leadership towards Sustainability (MSLS) program	France	>7 years	Public (e.g., municipality, government); Business and Private; Non-Profit (e.g., NGOs); Education and Academia
P2	As a student or alumni of the Master's of Strategic Leadership towards Sustainability (MSLS) program	Freelance	3-7 years	Business and Private; Non-Profit (e.g., NGOs)
P3	As a student or alumni of the Master's of Strategic Leadership towards Sustainability (MSLS) program	Vietnam	>7 years	Public (e.g., municipality, government); Non-Profit (e.g., NGOs)
P4	Through independent research or study	Sweden	close to 20 years	Public (e.g., municipality, government); Non-Profit (e.g., NGOs); Education and Academia
P5	As a student or alumni of the Master's of Strategic Leadership towards Sustainability (MSLS) program	Sweden	>7 years	Business and Private
P6	Other	Nordics, Åland Islands	>7 years	Public (e.g., municipality, government); Business and Private; Non-Profit (e.g., NGOs); Education and Academia
P7	Through another person who is a student or alumni of the MSLS program	Germany	>7 years	Business and Private; Education and Academia
P8	As a practitioner who was introduced to the process in a professional setting	Sweden	3-7 years	Business and Private
P9	As a student or alumni of the Master's of Strategic Leadership towards Sustainability (MSLS) program	Argentina	<3 years	Business and Private
P10	Other	Sweden	>7 years	Business and Private
P11	As a practitioner who was introduced to the process in a professional setting	Sweden	>7 years	Business and Private
P12	As a practitioner who was introduced to the process in a professional setting	Sweden	>7 years	Public (e.g., municipality, government); Business and Private; Non-Profit (e.g., NGOs); Education and Academia
P13	Through independent research or study	Sweden	>7 years	Business and Private; Education and Academia
P14	Other	Sweden	>7 years	Education and Academia

Appendix E: Semi-Structured Interview Flow for Interviews with Practitioners

- **Introduction:** Welcoming words and GDPR requirements.
- **Section A.1:** This section opened with general, story-provoking questions to understand how participants engage with the ABCD Process. Examples include:
 - o “How do you use the ABCD Process in your daily work?”
 - o “What skills do you feel you have developed while working with the ABCD Process?”

For participants less familiar with practical applications, follow-ups probed deeper into workshop details, facilitation dynamics, and outcomes.

- **Section A.2:** Once a Key Competency was implicitly or explicitly identified in a story of the practitioner, the interviewer would explore it further. This included prompts around:
 - o “To clarify, did you recognize the shared moment as an example of this Key Competency?”
 - o “How do you think did this Key Competency develop over time?”
 - o “In what way is this Key Competency developed in your personal experiences vs. observations in other people?”
- **Section B:** After exploring the emergent KCs from Section A, the interviewer returned to the UFCAST, addressing any KCs that had not yet been mentioned. This included a prompt with follow-up prompts as follows:
 - o “You haven’t talked about this Key Competency.”
 - “Is there a specific reason? Do you think this Key Competency plays a role?”
 - “Can you tell a story / given an example of when you have developed it?”
- **Closing:** The final portion included reflection on the entire set of Key Competencies where interviewees were asked to identify which KCs they believed were most or least aligned with the ABCD Process (“Top KC”). The interviewees were thanked for their time and answers.

Appendix F: Tables used for Interview Coding

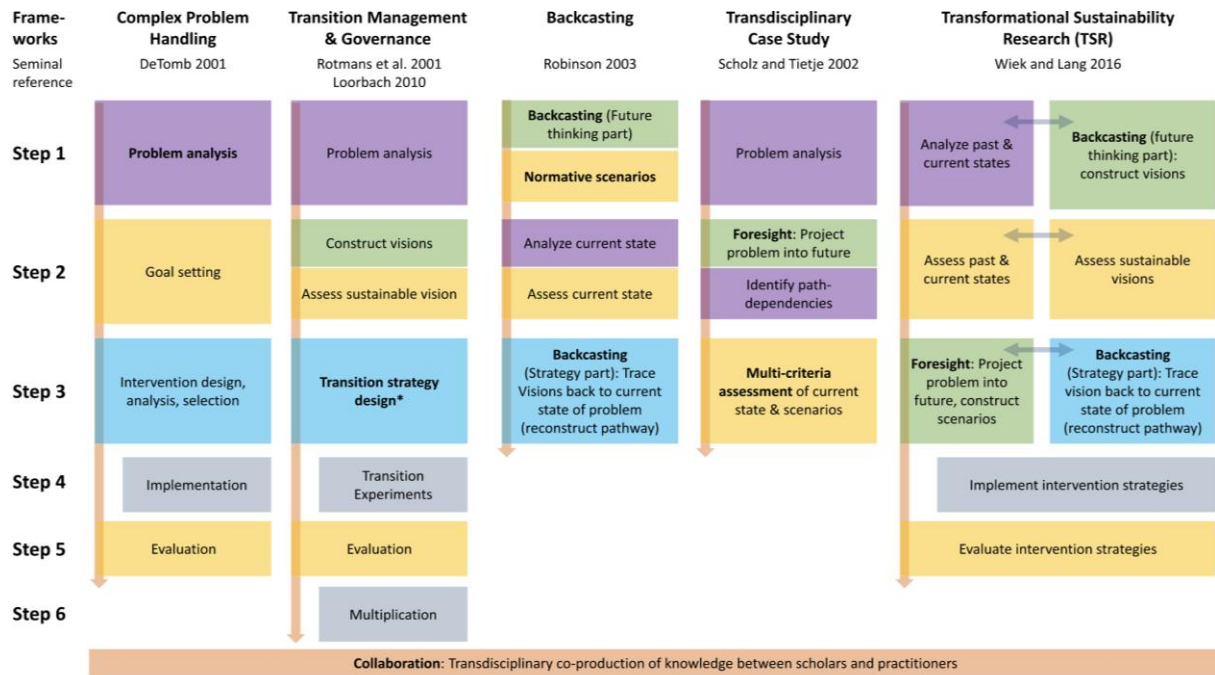
KC	Key Term 1	Key Term 2	Key Term 3	Key Term 4	Key Term 5	Key Term 6	Key Term 7
KC1	complex analytical approaches	modeling	analyze complex systems and sustainability problems across different domains (environmental, social, economic)	analyze complex systems and sustainability problems across different scales (local to global)	including cascading effects, inertia, feedback loops, and other system dynamics	to analyze the impacts of sustainability action plans (strategies)	to analyze the impacts of interventions (how they change systems and problems)
KC2	carry out or construct simulations, forecasts, scenarios, and visions	to anticipate future states and dynamics of complex systems and sustainability problems	to anticipate how sustainability action plans (strategies) might play out in the future (if implemented)				
KC3	to identify, map, specify, negotiate, and apply sustainability values, principles, and goals	to assess the sustainability of current and / or future states of complex systems	to construct sustainability visions for these systems	to assess the sustainability of action plans (strategies) and interventions			
KC4	to construct and test viable strategies (action plans)	for interventions, transitions, and transformations toward sustainability					
KC5	put sustainability strategies (action plans) into action	including implementation, adaptation, transfer and scaling, in effective and efficient ways					
KC6	to collaborate successfully in inter-disciplinary and professional teams	to involve diverse stakeholders, in meaningful and effective ways, in advancing sustainability transformations	to involve different employees from different levels & departments to work collectively				

KC7	to avoid personal health challenges and burnout in advancing sustainability transformations	through resilience-oriented self-care (awareness and self-regulation)					
KC8	to apply collective problem-solving procedures to complex sustainability problems	to develop viable sustainability strategies (action plans)	successfully implement them, in collaborative and self-caring ways				

KC	A-Step	B-Step	C-Step	D-Step	ABCD Process	Development of KC over time
KC1	00:00					
KC2						
KC3						
KC4						
KC5						
KC6						
KC7						
KC8						

Appendix G: Brundiens et al. (2021)'s mapping of the KCs to specific stages of integrated sustainability problem-solving approaches

Legend: KC1 - purple, KC2 - green, KC3 - yellow, KC4 - turquoise, KC6 - orange



Appendix H: Different Perspectives on Purpose and Application of the ABCD Process provided by Practitioners

1. *“ABCD is for me the best tool I know to bring a group to live through this sustainability journey together and to live through it in a simple, easy to explain strategy, powerful systemic way”*. (P1)
2. *“It's a process to plan in a complex system. So you know what is your desired future and where are you at and what are the solutions? And choose a few. It's just a very natural way for me to address any complex system”*. (P1)
3. *“One very important thing for me is that ABCD has to be applied in [a] spiral”*. (P1)
4. *“The ABCD Process the way it's designed, it's not designed to solve complex problems, it's more designed to help people structure a task in a digestible steps, [...] which are supposed to be iterative”*. (P2)
5. *“I would say ABCD is very helpful first when you trying to wrap your heads around the sustainability initiative. So you have a bit of long-term vision”*. (P3)
6. *“The ABCD works well while someone is there to facilitate [...] and see that the process is ongoing and also when there are people like a core team that do have the core knowledge [...] about the procedure and the systematic way of working”*. (P4)
7. *“The ABCD itself is a process to lead in complexity”*. (P5)
8. *“I'm really an ABCD nerd. I find it to be not just a tool, but I find it to be the key to actually bring people on board”*. (P6)
9. *“ABCD starts with A - awareness and then visioning, right, and baseline assessment and there is the biggest problem. It's not done with awareness, so we realize we have to separate two processes. We have to split ABCD into two processes. One is the process of becoming strategic, which is basically very straightforward. It's nothing new that ABCD came up with. It's knowing where you are. Developing an idea of where you would like to be which determines the gap. Become innovative about how you could close the gap and then decide on how you would like to approach that”*. (P7)
10. *“The purpose of the ABCD Process, the whole process is really shifting mindsets [...]. It is to get people to think in another way about how they have done business and how they're going to do business in the future”*. (P12)
11. *“The ABCD belongs in the strategy level”*. (P12)
12. *“For me, the ABCD is an engaged, stakeholder engagement process. You do it. You don't do it alone. You do it with [...] your key stakeholders.”* (P12)
13. *“So my daily work as a research and educator, I use it partly in my research. So the ABCD Process as well as other parts of the FSSD are a central point of a lot of the research that I'm doing. And the other part is as an educator where I'm teaching about this as a process for, well, creating a shared language. A shared mental model of understanding both sustainability and how to plan strategically for sustainability and to use that in my teaching”*. (P13)
14. *“The ABCD mindset and sometimes even explicitly as the ABCD Process is very much at the core of what we develop something around”*. (P13)
15. *“So I would see ABCD primarily as kind of a shell. It's a structure and then you can fill it with a lot of already existing support”*. (P13)
16. *“The ABCD is very helpful in my experience [as a] shared mental model for people to have much more effective dialogues and implementation work around when you can differentiate between ‘OK. Now we're actually talking about the vision.’ Or ‘Now we are just brainstorming ideas’”*. (P13)
17. *“On the other hand, the ABCD is I interpret it as first and foremost. It's a planning tool. It's to to create a strategic plan in a way”*. (P13)

18. *“The ABCD process is. Basically, sustainability gap analysis. That applies backcasting. As the reference point for the gap and then. Then it supports you a little bit in strategic thinking along the way to move from from the specified gap”.* (P14)



Master's Programme in Strategic Leadership towards Sustainability
Blekinge Institute of Technology, Campus Gräsvik
SE-371 79 Karlskrona, Sweden

Telephone: +46 455-38 50 00
Fax: +46 455-38 55 07
E-mail: sustainabilitymasters@bth.se