Blended Intelligence: A Framework for How Professionally Diverse Multi-disciplinary Teams Solve Problems in Elite Sport

by

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Dedication

For the cobbler who left too soon but left an indelible mark, the ballet teacher whose expectations were low but whose spirit sought to inspire, and to the little feet that never touched the ground.

The lonely wife, the joyful yet overlooked children, and the empty seats where laughter, love, and togetherness at times, have been missed.

Acknowledgements

I began my doctoral journey in 2017. During this time, I took on the challenge of running 52 half marathons in 52 weeks and 12 marathons in 12 months in support of the incredible charity, Winston's Wish.

Pursuing a doctorate is not unlike these endurance challenges, it's a labour of love, significantly challenging and enormously hard to accomplish, as anything is that pushes us beyond our current capabilities.

When running, step by step, stride by stride, the landscape, scenery, and environment shift and change around you. Similarly, in academia, people come and go, jobs change, thoughts evolve, and reflections deepen yet you keep moving forward, through the good and the bad, driven by the pursuit of your goal.

My goal, to submit this thesis and attain a doctoral qualification is something I never imagined I would achieve. If only my parents could see me now…

There are several individuals I would like to acknowledge for their contributions, whether direct or indirect, or for their unwavering support throughout this journey.

When I first joined the University of Lancashire to pursue this qualification, it was with the intention of working with Professor Dave Collins and Dr. John Kiely. Dave Collins is a true heavyweight scholar in the fields of Sports Science, Sports Psychology, and Professional Judgment and Decision Making (PJDM). Although I never had the opportunity to work with Dave as closely as I had hoped, his initial enthusiasm for my project provided the momentum I needed to get started and move in the right direction.

John was my Professional Doctorate (DProf) supervisor for a significant portion of my research. His guidance, reflective approach, and thought-provoking questions always energised me, enough to move forward, yet with just the right amount of doubt to leave me reflecting for days after our meetings.

Throughout this journey, I was privileged to be supported by Dr. Dave Rhodes. Dave was a pragmatic champion of my project, and his grounded feedback, advice, and direction were instrumental in shaping my studies. He also served as a valuable sounding board for study write-ups and publications. I was truly sorry to lose Dave from my supervisory team, but his ongoing support has been outstanding. Thank you, Dave.

When Dr. Chris Yiannaki and Dr. Jill Alexander joined my supervisory team, my research journey gained significant momentum. Chris played a pivotal role in transforming me from an average student trying to conduct research into someone who now understands complex concepts such as ontology, qualitative research methods, and reflexive thematic analysis. He has an incredible knack for asking introspective questions, something I both love and hate him for (sorry Chris)! Chris has endured challenging times himself, and in those moments, I want to extend a special thanks for the structure he brought to my methodological understanding and approach. Thanks, Chris.

Dave Rhodes introduced me to Dr. Jill Alexander as my new Director of Studies when he moved on to Burnley FC and the Premier League. Initially, I was concerned about how we would pick up and move forward from where Dave left off, but I need not have worried. Jill

has been a driving force in getting me to the finish line. Her proofreads, edits, suggestions, and insightful questions have gone above and beyond anything I could have hoped for. Between Jill and Chris, I have progressed further and faster than I ever imagined. Jill's positivity, enthusiasm, and unwavering belief in my ability to complete this journey gave me the energy and determination to push forward. This thesis is as much hers as it is mine (though I'm not sure I should say that!). Jill—thank you.

To Derek McHugh, who laboured over the methods and results of Study 1 for nothing more than my rather inadequate thanks—without your help, I would not have been able to build the rest of this thesis. I feel we share a love of decision-making science, and after all those late-night meetings, you must have developed one just to put up with me. Thanks, Derek.

I would also like to briefly thank the English Institute of Sport (now United Kingdom Sports Institute) and Aquatics GB for their support in allowing me to complete this thesis.

To the practitioners and leaders who contributed to the studies: I conducted reflexive thematic analysis on all our meetings, and I feel as though I know your voices and words deeply, even though, for you, it may have been just a brief encounter. I hope that the value of your words will live on and that others will benefit from the outputs of this project.

To anyone who takes the time to read my research papers or this thesis—thank you.

To my friends, whom I have undoubtedly neglected, I'm sorry, and thank you for tolerating me.

To my children, Ollie, Freya, Maisie, and Jessica, and my family, I know you have gone unnoticed for far too long. I'm sorry and thank you. I hope to be more present now.

And finally, Suzie, my friend, my wife, my soul partner.

Without you, none of this would have been possible. The sacrifices you have made to allow me to pursue a career in elite sport and complete both an MSc and a DProf cannot be understated. The highs, the lows, the pain, the grief, you have never doubted me and have always been my greatest champion. Thank you.

Two heads are better than one but conversely, too many cooks spoil the broth.

Abstract

Multi-Disciplinary Teams (MDT's) have become an important requirement of high-performance sport. Practitioners from diverse professional backgrounds work in silo and concert to deliver performance support services in the pursuit of enhanced individual athlete health, well-being and optimised performance outcomes. Whilst the MDT approach and performance support is well established there is a relatively limited body of research advocating for how these teams operate in practice and what they attend to. Anecdotally, practitioners and MDTs are expected to collaboratively solve performance problems and yet, to date, despite the terms common use and widespread reference across the literature, what this looks like in practice, why (and if) it is required and how teams go about this, is underdeveloped from a research perspective.

This thesis sets out to critically examine and better articulate the role of MDTs in high-performance sport focusing on their problem-solving and decision-making processes. The research aim is to explore how individual practitioners, MDTs, and high-performance leaders conceptualise and execute problem-solving within high-performance environments. The output of this thesis is a contemporary problem-solving framework that can be adopted or deployed by practitioners, teams, leaders and organisations to rationalise approaches to problem-solving, creating conditions to better access and leverage the expertise of the MDT and direct it appropriately to the requirements within the context. This consequently answers how high-performance MDT's solve problems in high-performance sport.

A pragmatic research design (Giacobbi et al., 2005) including both Likert scale surveys visualised through dual axis heat maps and a constructivist, qualitative methodology was employed using reflexive thematic analysis (Braun & Clarke, 2019). The research adopted an inductive, data-driven approach, emphasising the active role of the researcher in knowledge production. Data were collected through surveys, focus groups and semi-structured interviews with high-performance sport practitioners and leaders. Heat maps were created[1] to show patterns in practitioner responses whilst thematic analysis was used to identify patterns and emergent themes related to MDT collaboration and problem-solving.

Findings suggest that a continuum of problem-solving approaches was identified, ranging from routine, intuitive decision-making to deliberate, innovative problem-solving. Despite the increasing emphasis on cognitive flexibility, many practitioners default to discipline-specific, pre-established solutions rather than interdisciplinary collaboration and novel problem-solving. While MDTs are expected to collaborate, they often function as loosely connected groups of specialists. Key barriers that were identified to collaboration included ambiguity in roles and expertise, professional territoriality, and the absence of structured approaches to problem-solving and decision-making. Leaders in high-performance sport face systemic, structural, and interpersonal complexities that create 'wicked problems.' While cognitive diversity is crucial for effective problem-solving, leaders lack clear frameworks to harness this diversity. The research highlights the necessity for structured problem-solving methodologies, such as design thinking, to enhance MDT effectiveness and proposes a problem-solving framework for individuals, teams and leaders.

The body of work advances theoretical understanding by contributing to the literature on multi and interdisciplinary team dynamics, problem-solving frameworks, and applied cognition in

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[1] Example Heat Maps are presented in <u>Appendix D</u> showcasing the results from the first study.

high-performance sport. From an applied perspective, it highlights the importance of 'T-Skills' (meta-cognitive, interpersonal, and critical thinking skills) in MDT training and professional development. The findings suggest reframing MDTs as active problem-solving entities rather than passive collections of expertise, emphasising structured collaboration, leadership clarity, and integrated decision-making or problem-solving frameworks. The research underscores the need for high-performance sport organisations to implement structured problem-solving methodologies to maximise MDT effectiveness.

Implications for Practice:

1. Developing structured collaboration frameworks to optimise MDT integration.
2. Enhancing cognitive flexibility training for practitioners to bridge the gap between formal education and applied problem-solving.
3. Implementing leadership strategies that emphasise cognitive diversity and structured problem-solving.

This thesis provides a foundation for future research on the operationalisation of problem-solving within MDTs in high-performance sport, with implications for training, leadership, and organisational effectiveness.

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List of Abbreviations

Accredited Strength and Conditioning Coach	**ASCC**
Certified Strength and Conditioning Coach	**CSCS**
Decision Making Approach	**DMA**
Department of Methodology	**DoM**
Football Association	**FA**
Professional Doctorate	**DProf**
Extra Sensory Perception	**ESP**
Head of Discipline	**HoD**
Inter-Disciplinary Team	**IDT**
Multi-Disciplinary Team	**MDT**
Professional Judgement Decision Making	**PJDM**
Performance Support Team	**PST**
Problem Solving Type	**PST**
Problem Solving Approach	**PSA**
Recognition Primed Decision Making	**RPDM**
Return to Play	**RTP**
Reflexive Thematic Analysis	**RTA**
Strength and Conditioning	**S&C**
Scottish Institute of Sport	**SIS**
Sports Science and Sports medicine	**SSSM**
Trans-Disciplinary team	**TDT**
The Inter-professional Education Collaborative	**IPEC**
United Kingdom Coaching Certificate	**UKCC**
United Kingdom Strength and Conditioning Association	**UKSCA**
University of Lancashire	**UoL**
Volatile, Uncertain, Complex and Ambiguous	**VUCA**

Glossary of Terms

Adaptability – The capacity to adjust strategies and behaviours in response to change and uncertainty.

Ambiguous Problems – Ill-defined, complex, or wicked challenges that lack clear solutions and require creativity, collaboration, and exploration.

Clear Problems – Well-defined, simple, or tame issues with obvious solutions that can be addressed using standard methods.

Cognitive Diversity – Inclusion of varied perspectives, expertise, and ways of thinking to enhance problem-solving.

Communication, Coordination, and Cooperation – The essential requirements for solving well-defined problems effectively within a team.

Context – The situational and environmental factors influencing decision-making and problem-solving.

Covert Problems – Hidden, intangible, or less obvious issues that still affect performance.

Critical Thinking – The capacity to analyse, evaluate, and apply reasoning in problem-solving.

Fostering Environments – Creating conditions such as time, space, and aligned behaviours that support performance.

Good Judgement – Balancing information, risk, experience, and intuition in decision-making.

Heuristics – Simple mental shortcuts or rules of thumb used to make quick decisions, often applied to simple problems.

Ill-defined Complex Problems (Team) – Problems without clear solutions that require collaboration, shared understanding, and slow, deliberate analysis.

Information Analysis – Systematic gathering and evaluation of data to support logical, evidence-based decision-making.

Interpersonal Complexity – Challenges arising from relationships, communication, and behaviours.

Interpersonal Skills – Skills in communication, collaboration, and relationship management.

Intuitive Expertise – Rapid decision-making based on experience, pattern recognition, and heuristics.

Logic and Rational – Deliberate, evidence-based reasoning applied to complex problems.

Meta-cognitive Skills – The ability to reflect on and regulate one's own thinking and learning processes.

Navigating Complexity – Recognising shades of grey, adapting to change, and balancing flexibility with structure.

Overt Problems – Visible and explicit challenges that are clearly identifiable.

Performance – Outcomes related to athlete health, wellbeing, and effectiveness of performance support.

Performance Problem-Solving – Applying structured and innovative approaches to overcome challenges that affect performance.

People – The behaviours, relationships, and interactions of individuals and groups.

Planning and Purpose – Establishing direction and clarity to guide problem-solving.

Plan-Do-Review – Using cycles of planning, reviewing, and integrating diverse perspectives to reimagine performance.

Problem - A situation, person, or thing that needs attention and needs to be dealt with or solved.

Problem-Solving - A question that you have that can be answered via an experiment.

Professional Intimacy – Building supportive, trusting relationships that enable effective teamwork.

Psychological Safety – A team climate where members feel safe to contribute ideas and take risks without fear of negative consequences.

Role Clarity – Clear understanding of responsibilities and accountabilities within a team.

Set the Climate – Establishing a culture of openness, trust, and collaboration.

Shared Mental Models – Collective frameworks that enable team members to anticipate and coordinate actions effectively.

Shared Understanding – Collective agreement on goals, approaches, and intended outcomes.

Structural Complexity – Issues created by organisational design, hierarchies, and distribution of resources.

Structures – The formal arrangements of teams, roles, and reporting lines.

System Complexity – Problems linked to interconnected processes, workflows, and technologies.

Systems – Organisational processes, workflows, and technologies that enable or constrain performance.

Systems and Structures – Organisational mechanisms that support or hinder problem-solving.

Well-defined Simple Problems (Individual) – Problems with clear solutions that can be solved using routines, checklists, and traditional approaches, often through intuitive expertise.

Publications and Proceedings arising from this thesis

Peer Reviewed Journals

King, R., McHugh, D., Alexander, J., Kiely, J., Yiannaki, C., & Rhodes, D. (2024). Multidisciplinary Team Practitioners Working in High Performance Sport: Skilled Intuitive 'Doers' or Novel Problem-Solving Innovators. *European Journal of Sport Sciences*, *3*(2), 15–26. https://doi.org/10.24018/ejsport.2024.3.2.143

King, R., Yiannaki, C., Kiely, J., Rhodes, D., & Alexander, J. (2024). Multi-disciplinary Teams in High Performance Sport, The What and The How: A Utopian View or a Darker Reality. *Journal of Expertise*, *7*(4), 149-174.

King, R., Yiannaki, C., Rhodes, D., & Alexander, J. (2025). From Chaos to Clarity: How Leaders Leverage the Value and Impact of the Multi-Disciplinary Team in Elite Sport. Managing Sport and Leisure. *Under Review*

Relevant Knowledge Exchange/Presentations

Podcasts:

Ryan King on operating in complexity: Supporting Champions

https://www.supportingchampions.co.uk/110-ryan-king-on-operating-in-complexity/

The journey towards true Multi-Disciplinary Team connection with Ryan King: Men Behind Sport

https://www.menbehindsport.com/podcasts/untapped-potential/episodes/2148899041

Solve your wicked problems as a team: Training Science Podcast

https://www.menbehindsport.com/podcasts/untapped-potential/episodes/2148899041

Presentations:

Benfica Football Club: Thursday 15th May 2025

The MDT Practitioner T-Skills: Career periodisation

University of Bath: 21st Jan 2025 & 24th April 2025

Workshop 1: The Practitioner in the MDT: Critical Thinking[2]

Workshop 2: The MDT Practitioner: Interpersonal and meta cognitive skills

Sheffield Hallam University: 28th January 2025

The Practitioner in the MDT: Critical Thinking

Aquatics GB Team Managers Conference: Saturday 16th March 2024

Problem-solving using MDT: Adapting to Supporting Teams

Lille Football Club: September 14-16th 2022

Perspectives, Problems and Behaviour: Some ideas from the world of the High-Performance Practitioner

UKSCA: 23rd July 2020

Multi-Disciplinary Round Table Discussion with Dr Duncan French, Dr Marco Cardinale, Dr Ben Rosenblatt, Dan Lewindon and Ryan King

Other institutions:

English Institute of Sport Annual Conference 2018

Loughborough University

Sport Wales

University of Hartpury

University of Gloucester

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[2] See Appendix G for example presentation

Chapter 1: Introduction

1.1 Introduction

Multi-disciplinary 'cross-functional' teams (MDTs) are a cornerstone of high-performance sport, playing a critical role in performance environments. Having contributed to, managed, and led MDTs over two decades, I bring a unique perspective on the knowledge, skills, and expertise required for practitioners to effectively contribute to inter-professional teams and drive success.

At first glance, the function and operation of MDTs in sport may seem clear and well understood. It is often assumed that practitioners can seamlessly integrate into a well-functioning team and be effective from the outset. This assumption however may not always hold true, many practitioners may not be as well-equipped for these inter-professional environments as expected oftentimes leading to confusion, ambiguity and conflict. Of particular interest is the widespread use of the term 'collaboration' in sport. By definition, '*collaboration'* is to work together to overcome a common or shared problem (Burns & Collins, 2023). While it is frequently cited as a core value in teams and organisations, it is unclear whether the contexts, demands, and challenges faced by practitioners always necessitate a truly collaborative approach. This raises important questions about when and how performance support teams are actually required to collaborate and why.

Similarly, terms such as '*performance problem-solving*' and '*performance solutions*' are commonly used in high-performance sport, yet my experience as a practitioner, manager, and leader suggests that genuine team-based problem-solving is rare. More often, practitioners appear to operate within their specific domains, delivering individual solutions to predefined scenarios through familiar procedures rather than engaging in collective problem-solving.

Although there is an evidence base for different models of inter-professional teamwork, such as multi-disciplinary and interdisciplinary approaches across other industries, it is unclear how well these translate into high-performance sport. This raises an important consideration for practitioners, leaders, and organisations: how do individuals and teams truly integrate to provide holistic, high-performance support to coaches and athletes?

This thesis core objective is to explore how practitioners and MDTs function, as well as how leaders and organisations leverage their expertise. By examining problem-solving through the various lenses, the thesis explores what collaboration truly entails in high-performance sport. By capturing the perspectives of current practitioners, it is hoped that we can generate valuable insights and through this, develop resources that enhance practitioner effectiveness within MDTs. Additionally, by engaging with high-performance leaders, a better understanding of how they utilise MDT expertise and define the skills, competencies, and knowledge required for success in high-performance sporting environments may arise.

1.2 Researcher Journey

In 2001, I graduated with an honour's degree in Sports Coaching and Development. Truthfully, I didn't know what I wanted to do with my life and stumbled through a 'college to university' pathway. Each step seemed to open just as I was coming to the end of each current year of study, so I was lucky to graduate at all. There is another reality where I am a cobbler, fixing shoes with my dad, but in 1993, I came home to find my dad lying on the sofa dead from a massive heart attack. I was 15. This trauma had a profound impact on my life. As I finished school and moved through further education and my 20s, I have in the past struggled with depression and anxiety. I will come back to this later. I was badly bullied in my youth and losing my dad, I had very low confidence, I discovered the gym and weight training. I enjoyed the structure of training; it gave me purpose, and as I physically developed, I could see the return on my investment in time. I threw myself into it, prioritising it over everything else. It was this that opened my interest in sports science and coaching and set me on my academic path.

My professional path was one of luck; I started my career as a sports science lecturer. Trying to teach people not much younger than I was, without much life experience or understanding of the subjects I was expected to deliver was hard. I lasted two years before deciding to move on, the experience did force me to leave home, move to London, and grow up. This opportunity did give me a better grounding in subjects I should have learned while studying which aligned well with my passion for physical training and sport. I enjoyed teaching and had always gravitated towards mentoring and coaching despite not having much to offer, I was keen to help.

In 2003, Strength and Conditioning (S&C) in the UK was in its early stages. I learned about the NSCA and the Certified Strength and Conditioning Specialist Credential (CSCS). I was inspired by the idea of working as an S&C Coach with high-performance athletes and set this as my goal. My focus was to work for the Scottish Institute of Sport (SIS), and I did everything to develop the necessary skills and knowledge. My first S&C role was with the University of St Andrews, where I developed an S&C facility, a performance support service, and gained the UKSCA Accredited Strength and Conditioning Coach (ASCC) certificate, I was one of the first to gain this qualification having been a founder member of the UKSCA. I was quickly asked to work for the SIS as a contractor coach and soon after, achieved my goal becoming a full-time S&C Coach. I worked at the SIS for 10 years. Initially, I led facilities, part-time coaches, and the Swimming and Curling programs. I was promoted quickly and, by the time I left SIS, I had led, managed, mentored, and coached many SIS fulltime coaches and several Scottish and World Class programs. Despite my success, I always felt like an imposter and had very low confidence. This was partly due to my education pathway and a strongly held belief that I was not 'academic'.

In 2012, driven by a perceived need to gain more academic credibility I returned to university as a mature student to pursue a Masters. This experience was different; I loved learning, felt engaged, and excelled, graduating in 2014 with first-class distinction and a UKCC level 4 equivalent qualification. Achieving my MSc was a proud moment and taught me that my academic capacity was greater than I believed. My studies in coaching and sports science respectively sat in different ontological and epistemological camps, this has helped develop both my understanding of and ability to deliver qualitative and quantitative research perspectives and methods.

It was through my MSc supervisor Alan Lynn that my interest in decision-making science and intuition developed. Initially influenced through the work of John Lyle (Lyle, 2010; Lyle & Cushion, 2010) and Gary Klein (Klein, 1993, 2004), I journeyed deeper into the literature and world of neuro and behavioural economics exploring Daniel Kahneman and Amos Tversky's Nobel prize winning work (Kahneman, 2011; Kahneman & Tversky, 1984; Tversky & Kahneman, 1974) becoming fascinated by meta-cognition, mental models and heuristics. As I became more aware of concepts of cognition and decision making, I became fascinated in schemas, mental models and how coaches make sense of what they observe. I was particularly influenced by Cushion et al. (2006) work discussing models 'for' and 'of' coaching, essentially, differentiating between what (coaches' observable behaviour) and why (coaches' cognition) coaches do certain things. This work shaped my master's dissertation on the cognition of high-performance weightlifting coaches and introduced me to mixed methods (Vergeer & Lyle, 2009) of qualitative research. During these two years, my mum lost her battle with cancer, I married my wife Suzie, and we had our first daughter Jessica, while working a demanding full-time high-performance role and serving on the UKSCA Board of Directors.

In 2016, I hit a glass ceiling in Scotland and joined the English Institute of Sport (EIS) as an S&C Technical Lead. Here, I led, managed and mentored staff in British Cycling, GB Taekwondo, England Squash, and England Netball whilst contributing to the leadership of the S&C service. The EIS provided significant personal growth, introducing me to incredibly smart people and fuelling my interest in a doctorate. In 2017, I signed up for a professional doctorate at the University of Lancashire, initially exploring coaching and heuristic decision-making under Prof. Dave Collins and Dr. John Kiely, the intention was initially to continue my work in cognition and decision-making.

I have always been introspective, reflective and principled. Through my research I had been influenced particularly by the work of Robyn Jones (Jones, 2007; Jones, 2006), drawing on Schon's models on reflection personally challenged me to make sense of the different people's motivations and agendas around me, my relationships and the role I play supporting them. I was now 36 and had two daughters, Maisie arrived in 2015. Having children forced me to face undealt-with grief and issues from my childhood. In 2016, I ran 2000 km for the amazing charity Winston's Wish, supporting bereaved children and families.

My passion for S&C was waning, it no longer felt that this was the thing that was making the difference, this was driven in part by my work trying to support MDTs to work collaboratively to solve 'performance problems'. I could see that there was dysfunction and disconnect across MDTs and a real lack of clarity in the application of critical thinking skills (decision-making and problem-solving) by practitioners and teams. I craved the next step: becoming a Head of Performance Support would give me the ability to help align a support team with the coaches and their process, something I now felt equipped to take on. In 2018, I became the Head of Performance Support at the FA and paused my studies to focus on the job and re-evaluate my research path.

I worked at the FA for nearly five years initially as Head of Performance Support for the Women's Super League and Talent pathway and am proud of my work and what we achieved there. I met amazing people, including David Faulkner MBE, who shaped my approach to relationships and is someone I would hope to emulate as a leader. Over those five years, my interests shifted to decision-making, problem-solving, and cognitive diversity where I was

heavily influenced by the work of Scott Page (2019). I was now managing MDT practitioners, and I continued to struggle to reconcile practitioners' approaches and behaviours with the language used and expectations placed upon them in high-performance sport.

In 2018, we welcomed Freya to the family, and in 2021, I ran 52 half marathons in 52 weeks, followed by 12 marathons in 12 months in 2022, again for Winston's Wish. I was headhunted by a Data and Analytics Company as a Senior Performance Strategist helping some of world's biggest sporting brands to find solutions to their most difficult problems through data. On paper this job would have been a good fit for my experience, expertise and research interests but the reality didn't align with my expectations. After recommencing my DProf and welcoming Ollie, our fourth child, I was made traumatically redundant. This setback was huge, however in hindsight, it was a relief.   In my most recent position I was Sports Science and Medical Lead with Aquatics GB where I led Performance Problem-Solving and Performance Planning across the Governing Body attempting to bring my research to life in a practical context.

It has been fascinating socialising the ideas of my research in a high-performance setting.   I have learned that practitioners struggle to move away from processes and routines that they are familiar and comfortable with preferring to offer traditional solutions to traditional problems within their professional lane.   Asking practitioners to engage in finding creative solutions to complex problems as part of an MDT approach has been challenging.   My professional doctorate exploring problem-solving at practitioner, team and leadership level has challenged me to think about how practitioners operate, how they integrate and how they are led. Particularly from a systems and structural level I believe that radical steps could be taken to enhance both collaborative problem-solving and the operations of MDTs.   Whilst I have not been able to implement some of my ideas in my work yet, I believe that my research offers a novel angle to the work of MDTs in sport and that it is challenging several status quo's (educational; assumptive and structural).

My studies are nearing completion, shaped by my 25 years of experience. Looking back on my researcher's journey I conclude that life is turbulent, and working in sport is unpredictable. Reflecting on my journey, it's been marked by grief, challenge, and adversity. Despite this, I am proud of the determination, drive, and resilience that it seems I have developed and that have brought me to this point.

1.3 Philosophical Approach

My academic journey in Sports Coaching, Sports Development, and Performance Coaching primarily involved practical and applied learning, with limited exposure to theoretical foundations. It was during my pursuit of this Professional Doctorate that I began to become aware of and explore ontological and epistemological perspectives. Prior to this, my understanding of objective versus subjective truth was superficial, lacking the philosophical depth and associated lexicon that I have since acquired.

As an adjunct of Sports Science, Strength and Conditioning has traditionally aligned with a realist, positivist paradigm. Within this field, practitioners are expected to adopt an objective, positivist stance, relying on empirical methods to measure and validate their interventions

through reliable and valid tests. This empirical, data-driven approach is foundational in Sports Science, emphasising measurement, objectivity, and statistical analysis to establish credible knowledge.

Consequently, an interest in decision-making, meta-cognition, and behavioural economics grew during my master's studies, which leaned towards cognitive psychology and sociology rather than purely positivist scientific methods. For my master's dissertation on high-performance weightlifting coaches' expertise, I employed a grounded mixed-method (Vergeer & Lyle, 2007) approach, blending qualitative and quantitative methodologies. This was a significant departure from my earlier empirical focus, highlighting the importance of philosophical perspectives and subjective truths in understanding complex phenomena.

1.3.1 Overarching Methodological Considerations

Recent interest in Sports Science and Medical Teams (Alfano & Collins, 2021) and Performance Support Teams (Stewart et al., 2024a) have seen researchers adopt qualitative research methods with a view to investigating participants experiences and lived aspects of their roles to shed light on how they operate. This thesis is underpinned by philosophical assumptions based in relativism and interpretivism. Relativism states that an individual creates their own reality which can be influenced by mind state and mood, thus, reality is multiple whilst certain types of knowledge can be subjective and shaped by an individual's experience, thus a person's perception, is their truth and highly idiosyncratic (Sparkes & Smith, 2013).

While this research adopts a pragmatic approach (Giacobbi et al., 2005) to answering applied questions, it is also informed by relativism and interpretivism, acknowledging that knowledge is shaped by individual experiences and perceptions. We acknowledge that while objective reality exists, our understanding of it is always influenced by human perception, biases, and social contexts. Given that this thesis explores how practitioners and leaders perceive their work as individuals and within teams, qualitative methods and approaches provided appropriate tools to assess the nuance of human behaviour and how individuals perceive their reality working in sport. To address the questions in this thesis initially a combination of Likert scales was employed to measure the strengths of perceptions of how practitioners work visualised through dual axis heat maps. This post-positivist method acknowledges that reality cannot be fully known, and that interpretation of the questions introduces potential bias (both the researcher and respondents). While the Likert scale survey provides structured, measurable insights (post-positivist), the qualitative analysis captures subjective perspectives through an interpretivist lens, ensuring a comprehensive understanding of practitioner experiences. An interpretive/constructivism stance was, as a result, adopted (Sparkes & Smith, 2013) to explore practitioners and leader's perceptions and experiences. This step employed Reflexive Thematic Analysis (RTA) (Braun & Clarke, 2006), which we conducted on focus group of high-performance sport practitioners and semi-structured interviews with high performance leaders.

The themes examined in this thesis are problem-solving, decision-making, collaboration and teamwork in high-performance sports. The nature of both critical thinking and inter-personal skills is such that they are required within most of what we do and are both interpreted and approached in very different ways depending on the individual, the context and their experience.

To explore problem-solving and decision-making by practitioners and teams, taking a classical realist approach would have proved inadequate, because human behaviour, how humans perceive reality and how humans interact with one another is far more complex than be explained through objective observable means. There is always context, nuance and a host of complex interactions that cannot be explained by the quantification of observed behaviours. The paucity of existing research on the target population necessitated an exploration of new research avenues, aiming to inform training and support for practitioners, and bridge the gap between the science of decision-making and its practical application in the world of sport.

Recognising the complexity of practitioners' roles within MDTs, a constructivist approach was adopted in studies 2 and 3. Consequently, the use of RTA in Chapter 4 and Chapter 5, aligns with constructivist epistemology, where themes are co-constructed through researcher interpretation and participant meaning making. This paradigm acknowledges the constructed nature of reality and emphasises understanding subjective experiences and interpretations (Braun & Clarke, 2006, 2019). Utilising Likert scales, focus groups, and semi-structured interviews, qualitative data was gathered to explore practitioners' and leaders who work in high-performance sport perspectives on their work.

The Likert scale survey in the first study (Chapter 3) provided a baseline understanding of practitioners' views, allowing for innovative analysis through heat maps and dual axis plotting. While not establishing causation, this method offered rich insights into decision-making and problem-solving processes of Practitioners.

1.3.2 Qualitative Analysis within the thesis

Reflexive thematic analysis enabled the identification, analysis, and reporting of patterns within qualitative data (Braun & Clarke, 2006) and has become popular in sport (Braun & Clarke, 2019), allowing the researcher to situate themselves within the research context. This approach was essential for exploring perspectives and subjective 'lived' experiences (Sparkes & Smith, 2013) in a relatively under-researched area. Focus groups (Gill et al., 2008) and interviews (Vergeer & Lyle, 2007) with MDTs and leaders provided a pragmatic foundation for understanding the construction of sense-making, critical thinking, and social constructs within sport. Despite some research now being available on MDTs in high performance sport, my interest was specifically on whether MDT practitioners value collaboration and how they do this whilst gathering views on their understanding and application of problem-solving and decision-making in their work. This is a novel avenue of research and therefore, these pragmatic methods and methodology were very appropriate for exploring the subject matter.

Study 3, whereby leaders were the recruited population, the use of certain leadership models in high performance elite contexts could have been assessed. Yet, this was not the objective of the research question. The objective was to establish leader's views and perspectives of MDTs, problem-solving and decision-making and through this, establish how they leverage MDTs to create favourable outcomes. Consequently, RTA through semi structured interviews was a perfect method for extracting meaning from our leaders and enabled the development of thematic maps and a model that depict what leaders attend to and how they do it. This insight would not have been gained had existing leadership models from the literature been tested, given the specific lens of interrogation guiding the study.

The constructivist approach, with its emphasis on qualitative, subjective paradigms, proved sensible and pragmatic when coupled with the Likert scales for the themes examined in this thesis. By exploring the nuanced, complex interactions within MDTs and the subjective experiences of practitioners, this methodology has provided valuable insights into decision-making and problem-solving in high-performance sports. This philosophical shift has supported the bridging of the gap between empirical evidence and the practical realities of sport, offering a comprehensive understanding of the dynamics at play in high-performance environments.

1.3.3 Reliability and Trustworthiness

In this body of research, reliability and trustworthiness in each study were addressed through methodological rigor in quantitative and qualitative approaches. The Likert scale survey, as a post-positivist method, ensured reliability through consistent question design, clear response scales, and systematic data analysis (Andrew et al., 2019) . Meanwhile, the trustworthiness of qualitative data was ensured through credibility, dependability, confirmability, and transferability (Nowell et al., 2017). Credibility was enhanced by triangulating focus group discussions and interviews, allowing for multiple perspectives on key themes. Reflexivity played a crucial role in RTA (Braun & Clarke, 2019, 2021a, 2021b), ensuring researcher awareness of biases and subjectivity. Dependability was strengthened through a transparent coding process, while transferability was supported by rich descriptions of practitioner experiences, enabling readers to assess the applicability of findings to other high-performance sports contexts (Levitt et al., 2017).

1.3.4 Ethical Approvals

Ethical approvals for the body of research presented in this thesis were approved by the University of Lancashire (UoL) ethics committee (Appendix A and B). All research was carried out in accordance with the conditions and recommendations of UoL ethics committee and the Declaration of Helsinki (2013). Data collected in all studies as part of this thesis was anonymised and remained confidential between the research candidate and the supervisory team. Individual ethical processes are presented in further detail as part of each study and associated publication (see Chapter 3.2.3; Chapter 4.2.3 and Chapter 5.2.3).

1.4 Approach to the Professional Doctorate

Figure 1 below illustrates the steps taken to answer the research questions and develop the thesis. It provides an overview of the scientific evolution of working practices, highlighting key areas of research that have informed the thesis's conception and identifying areas for further investigation.

Problem-solving in high-performance sport

Scientific evolution of working practice

Decision making	Problem-solving	Cognitive Diversity	Team

Decision making: Dual Systems, Decision Types, Intuition, Heuristics, Logic
Type 1 – Type 2, Deliberative, Expertise, Bounded Rationality
Fast-Slow, Non, Semi, NDM, IPD, PJDM, Fast, Frugal, Speedy

Problem-solving: VUCA, Cynefin Matrix
Well – Ill defined, Tame - Wicked, Procedural - Novel
Process & checklists, Creativity

Cognitive Diversity: Diversity, Individual Ability
Knowledge Work, Doing Work
Mental Model, Heuristics, Knowledge, Perspectives, Tools

Team: MDT, IDT, TDT
Structure, Teaming
Psychological Safety, Ego, Trust

What is performance problem-solving in high-performance sport?

Three different lenses on problem-solving.

The Studies

Individual practitioner
Are MDT High-Performance practitioners skilled 'doers' or novel problem-solvers?

The MDT
What do practitioners do and how do they operate as part of MDT in high performance sport?

The Leader/Organisation
How leaders maximise the impact of MDT in elite high-performance sport and what do they do?

The role of T-Skills in MDTs

Defining problem-Solving & Collaboration

Design thinking in MDTs

Considerations

Problem-Solving Frameworks

Figure 1: Overview of general approach to answering the thesis question[3]

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[3] The learning process began with the module 'scientific evolution of working practice' where decision-making, problem-solving, cognitive diversity and team science was explored. This led to the focus of the thesis which was to better understand what performance problem-solving in high-performance sport and how this is approached through three separate lenses, leading to the creation of problem-solving framework.

1.5 Statement of the Research Problem

The problem this thesis seeks to address revolves around the role and effectiveness of MDTs in high-performance sports, outlined in Table 1. While MDTs are a well-established practice in professional sports, there is limited clarity on how practitioners within these teams effectively collaborate, make decisions, and solve complex problems. There is an anecdotal assumption that MDTs function seamlessly, yet practitioners may not be adequately prepared for inter-professional teamwork, often leading to ambiguity, inefficiencies, and challenges in integrating expertise across disciplines. Furthermore, the term 'problem-solving' is frequently used in high-performance sport, yet its application within MDTs remains unclear, with a tendency for practitioners to operate in silos rather than engage in collective, innovative problem-solving. The overarching research aim, and objectives are presented below in Table 1 and provides the reader with further and specific research questions, aims, objectives and findings from the studies conducted across the research elements of the body of work.

1.6 Research Aim and Objectives

Research Aim:

The overarching aim of this thesis is to explore how MDT practitioners in high-performance sport engage in problem-solving and decision-making and how leaders leverage MDTs to enhance their effectiveness.

Research Objectives:

1. To understand the cognitive approaches and decision-making styles employed by MDT practitioners in high-performance sport.
2. To identify the challenges and facilitators of effective MDT collaboration in high-performance sport environments.
3. Examine how high-performance leaders optimise the impact of MDTs to drive performance outcomes.

1.7 Thesis Overview and Structure

Table 1: Thesis Overview and Structure.

Overarching Aim	To explore how MDT practitioners in high-performance sport engage in problem-solving and decision-making, as well as how leaders leverage MDTs to enhance their effectiveness.		
	Study 1	Study 2	Study 3
Question	**Are MDT High-Performance practitioners skilled 'doers' or novel problem-solvers?**	**What do practitioners do and how do they operate as part of MDT in high performance sport?**	**How leaders maximise the impact of MDT in high-performance sport and what do they do?**
Study Aim	– To understand the cognitive approaches and decision-making styles employed by MDT practitioners in high-performance sport.	– To identify the challenges and facilitators of effective MDT collaboration in high-performance sport environments.	– Examine how high-performance leaders leverage and optimise the impact of MDTs to drive performance outcomes.
Objectives	1. Identify cognitive approaches that are applied by practitioners to delivering their work 2. Identify problem types, problem-solving and decision-making approaches applied by practitioners in their work 3. Identify methods and approaches of work that are applied by individual practitioners	1. Identify barriers and facilitators to effective MDT working 2. Understand the experiences of operating as part of an MDT by practitioners 3. Explore the experiences of practitioners in collaboration, problem-solving and decision-making when working as part of an MDT	1. Identify leader's perspectives and views of MDTs in sport 2. Identify how leaders of MDTs operate and what they do to maximise the value and leverage the expertise and capabilities of the MDT
Methods	• 71 Likert scale survey • 115 MDT Practitioners responded • Likert scale statements constructed in line with literature	• 5 Focus groups • 28 MDT High-performance Practitioners • 6 questions analysed using reflexive thematic analysis • RTA allowed us to explore views, beliefs and perspectives of practitioners	• 8 semi-structured interview • 8 high-performance leaders from diverse backgrounds • 7 questions analysed using reflexive thematic analysis • RTA offered a means of exploring a range of topics and leaders views, perspectives and beliefs
Results	**Our continuums** – constructed based on literature:	• Practitioners focus performance and athlete wellbeing	• Leaders attend to a people domain comprising of professional intimacy,

	• **Problem Solving type** (Simple-Complex) • **Problem-Solving approach** (Procedural-Innovating) • **Decision-Making style** (Fast-Slow) • Practitioners appear to solve simple problems • Practitioners appear to favour procedural type work • Practitioners make type 1 (fast) decisions • Practitioners rely on intuitive 'heuristic' semi-deliberative decisions • Although these were the findings, they were not equivocal presenting a messy overall picture.	• Four themes were constructed highlighting challenges and opportunities to maximise practitioner performance as part of MDTs. • Cognitive diversity is important but not if it slows us down, • Staying in your lane is encouraged however sharing and collaboration is important • We need psychological safety; however poor behaviour keeps getting in the way • High confidence in a world of nuance and uncertainty; adaptability and context is key.	fostering high-performance environments, and setting climates. • The context domain comprises of navigating complexity, good judgement, and performance problem-solving. • The study highlights that leaders in high-stakes sports environments must exhibit confident judgment within complex, unpredictable systems
Outputs	• Framework for thinking about decision-making and problem-solving • Acknowledgement of dissonance between the language of problem solving in sport versus how practitioner actually work (processes/procedures)	• Thematic map and figure outlining what MDT practitioners do and how they operate • Practitioners struggle to differentiate between problem-solving and decision-making • Practitioners require strong inter-personal skills to problem solve	• Thematic Map and figure depicting what and how leaders operate • Both problem-solving and decision-making are critical requirements of leaders in high-performance sport • It appears that although problem-solving is important, the language is implicit as opposed to explicit
So What?	• Practitioners don't work in isolation • Practitioners report working with complex problems • Complex problems require cognitively diverse teams to provide better solutions	• Practitioners present a utopia of what MDT working is • Practitioners likely build this utopia through reflection, challenge and failure born out of a darker reality • The findings suggest leadership, team dynamics and psychological safety plays a critical role in effective MDT working	• Leaders should focus on organisational structure (horizontal integration) of teams for better problem solving • Leaders should deploy clear processes to differentiate problem types and approaches

Chapter 2: Literature Review

2.1 Introduction

There is a strong body of evidence advocating the benefits of a multi-disciplinary approach across a variety of professions including military (Fiore et al., 2008), health care (Lanceley et al., 2008; Taberna et al., 2020), sports science and coaching (Alfano & Collins, 2021; Inchauspe et al., 2020; Salcinovic et al., 2022; Stewart et al., 2024b). It is recognised that through multi-disciplinary teams (MDT) better outcomes can be achieved (Hall & Weaver, 2001; Mello & Rentsch, 2015; Salas, Fiore, et al., 2010). In professional sport the terms 'high-performance' and 'elite' have been challenged and definitions sought (Swann et al., 2015). McAuley et al. (2022) calls for greater transparency in population samples where the term *elite* is used as such, clarity of the terminology used throughout the thesis was considered. When referring to the terms 'elite' or 'high-performance' the studies presented in this thesis refer to High-performance Professional Sport, World Class Programmes or within a Professional Sports Institute where World Class Programme athletes aligning with what Swann et al. (2015) classify as Level 4 when defining elite are supported.

In high-performance sport the MDT approach is commonplace and yet to date, there is still little research exploring how they operate and what makes them effective (Reid et al., 2004; Stewart et al., 2024b; Tee et al., 2020). Despite a lack of understanding, industry is moving towards and adopting the language of 'inter' and even trans-disciplinary team working approaches (Rothwell et al., 2020; Vaughan et al., 2019; Woods et al., 2021). For individual practitioners working in high performance sport, there is a lack of guidance, training, or support on how to work effectively as part of an MDT or why it is required (Burns & Collins, 2023; Burns et al., 2024). It may be that beyond the hard 'technical' skills that practitioners develop through their education (Collins et al., 2015), they do not receive training that support multi-disciplinary ways of working and cross discipline integration.

The integration of MDT in high-performance sport has been a topic of increasing interest since the early 2000s (Collins et al., 1999), reflecting a shift from isolated practitioner expertise to collaborative approaches for optimising athlete performance (Reid et al., 2004). Despite the recognised benefits of MDTs, including the potential for enhanced service delivery (Tee & Rongen, 2020) and holistic athlete support, challenges surrounding team dynamics, communication, and professional boundaries persist (Burns & Collins, 2023; Stewart et al., 2024a). While healthcare has established a substantial body of research on MDT effectiveness (Leeftink et al., 2020; Nancarrow et al., 2013), the sporting domain remains relatively underexplored (Alfano & Collins, 2021; Stewart et al., 2024a), leaving a critical gap in understanding how these teams function in practice.

One key issue is the inconsistent use of terminology when describing inter-professional collaboration in sport. Terms such as mono-disciplinary (Doherty, 2013), multi-disciplinary (Tee & Rongen, 2020), inter-disciplinary (Burns & Collins, 2023), and transdisciplinary (Rothwell et al., 2020) are frequently applied interchangeably, leading to conceptual ambiguity (Burns & Collins, 2023; Stewart et al., 2024a). While the literature differentiates these frameworks in theory, their practical implications for athlete support, decision-making, and performance outcomes remain insufficiently examined. Furthermore, research tends to focus

on the structural composition of MDTs rather than the operational realities of how individual practitioners navigate their roles within these teams (Alfano & Collins, 2021).

This literature review seeks to highlight a critical gap in the literature, on how MDTs are structured and how individual practitioners contribute to team effectiveness. There is an implicit assumption that professionals from different domains can seamlessly integrate their expertise, yet limited research has explored the mechanisms through which this occurs, the challenges it presents, or the conditions necessary for success (Salcinovic et al., 2022). Additionally, while studies have identified broad determinants of effective teamwork, such as leadership (Arnold et al., 2018; Fletcher & Arnold, 2015), shared mental models (Ashford et al., 2023; Salas, Fiore, et al., 2010; Stewart et al., 2024a) , and communication (Salcinovic et al., 2022; Stewart et al., 2024a) there remains a lack of clarity on the practical application of these findings in high-performance sport settings. By critically examining existing research and identifying areas requiring further exploration, this literature review seeks to identify key questions that will form the basis of this thesis.

2.2 The MDT in Sport

As far back as 1999 there has been an interest in the challenges of the MDT approach in high-performance sport (Collins et al., 1999). Anecdotally, where there has been a proactive push towards an MDT approach it may not have seamlessly transferred to sporting domains where 'groupings' were seen as an incidental by-product of accessing a wide range of services (Reid et al., 2004). Reid et al. (2004) were amongst the first authors to recognise that whilst there is a net gain to be made from engaging different disciplines, there is a considerable risk of conflict and confusion. It has not been until recently that researchers have recognised the need to explore MDT working in sporting contexts with the risk of confusion, conflict and issues still cited as pervasive even today (Alfano & Collins, 2021; Alfano & Collins, 2023; Burns & Collins, 2023; Burns et al., 2024; Salcinovic et al., 2022; Stewart et al., 2024a, 2024b). Given the proliferation of practitioners from different professional backgrounds being employed by high performance, professional and Olympic sporting organisations to form cross-disciplinary teams (Jowett, 2024), research investigating this approach is still relatively untapped, creating a fertile gap for further exploration.

It is worth noting that anecdotally and through the literature, terminology surrounding the nature of inter-professional team working in sport is considered confusing (Burns & Collins, 2023; Stewart et al., 2024a). This current reality is similar to the health care sector which despite being far more mature from both an industry and research perspective, it still contends with significant confusion over terminology and its application (Martin et al., 2022; Zajac et al., 2021). Mono-disciplinary (Doherty, 2013), multi-disciplinary (Inchauspe et al., 2020; Reid et al., 2004; Tee & Rongen, 2020), inter-disciplinary (Burns & Collins, 2023), transdisciplinary (Otte et al., 2022; Rothwell et al., 2020; Vaughan et al., 2019; Whitley et al., 2022) and now department of methodologies (Otte et al., 2022; Otte et al., 2020) are all terms that are used in reference to inter-professional *multi-team* working in sporting contexts. Whilst we can differentiate the terms, the purpose of these different approaches to team working in high-performance sporting contexts (qualified by Swann et al. (2015) as working with level 4 international athletes) and why they might be required is not well qualified and under

researched. Firstly, by defining the terminology applied through the literature to each type of teamwork it is hoped we can be clear on the appropriateness of its use and purpose in practice.

2.2.1 Mono-disciplinary

Individual's operating within their silo (such as physiotherapy, nutrition, sports science, biomechanics, psychology) servicing the coach and athletes in isolation could be considered a monodisciplinary approach. The literature often cites the limitation of a mono-disciplinary approach as too reductionist and overly simplified (Doherty, 2013) with Piggott et al. (2020) arguing that whilst measuring variables within a discipline serves a reductionist paradigm, it fails to acknowledge the complexity and interacting elements of sports performance across training and competition. It should be noted that to qualify within a profession individuals must undertake years of undergraduate, graduate and professional training (Collins et al., 2015). Despite the years of investment in academic and vocational training to qualify within a professional domain, there is a confusion (Reid et al., 2004) in how the expertise, skills and delivery approach from one profession might interact, integrate or blend with those of another when providing service. Further, the assumption that individuals from different professional disciplines can effectively collaborate with one another and integrate with the coaching process seems unexplored from a research standpoint. Despite widespread recognition that interactions between individuals (athlete) and their environment (Vaughan et al., 2019) encompassing physiological, psycho-social, perceptual-cognitive-motor (Otte et al., 2022; Piggott et al., 2020; Rothwell et al., 2020) collectively shape outcomes in sport, practitioners that are trained within a rigid academic framework may hinder the integration of these factors in practice, potentially pushing delivery further toward mono-disciplinary methods.

Jowett (2024) recently observed that the dyadic coach-athlete relationship, fundamentally driven through trust, cooperation and communication benefits from input from different service providers. In that conceptual paper practitioners are referred to as 'cross-disciplinary' experts that are brought in through a dynamic teaming (well socialised across the literature by Edmondson (2012)) approach to service specific performance needs of the athlete. The outcome of Jowett's (2024) conceptual analysis advocates for mono-disciplinary servicing born out of specific needs led by the coach and athlete. Central to the success of this approach is the clarity of vision, mission, goals or objectives set by the leader (in this case coach). In the examples given within Jowett (2024), 'dynamic teaming' would appear a good fit as servicing interventions appear to be acute, short term and finite in duration, previously acknowledged by Edmondson (2012) as critical requirements of the teaming approach. That said, much of the work undertaken by the disciplines is not 'short term' or 'acute' in nature but instead requires a sustained 'chronic' approach to bring about meaningful change. Examples include the development of strength, proactive strategies to reduce injury burden, and the interdependent management of training load and recovery. Importantly, this work frequently necessitates the integration of approaches from multiple disciplines.

2.2.2 Multi-disciplinary

The term multi-disciplinary is synonymous with health care. Within this context there is a significant body of research advocating for its use, effectiveness and impact (Leeftink et al.,

2020; Seckler et al., 2020; Taberna et al., 2020) on patient outcomes. Nancarrow et al. (2013) acknowledges challenges in research that seeks to explore effective teamwork given its multifactorial nature comprising of skill mix, setting of care, service organisation, individual relationships and management structures. Further, most research seeks to explore a few of these aspects rather than relationships among several components on a range of staff and patient outcomes. Leeftink et al. (2020) define multidisciplinary care as systems where multiple interrelated appointments per patient are scheduled where health care professionals from various facilities or with different skill sets are involved. In sporting research contexts, Doherty (2013) distinguishes multidisciplinary as informal consultation amongst investigators, it was proposed that collaborators generally from different disciplines work independently (in parallel or sequentially) to form a broader understanding of a phenomenon.

The importance of the MDT approach in team sport is not in question where there is an acknowledgement that improving athletic performance depends on the interaction of several (physical, technical, tactical and psychological) factors (Inchauspe et al., 2020). Indeed, in one of the few applied studies exploring MDT effectiveness, Tee and Rongen (2020) investigating injury reduction through an MDT approach found that shared values, expertise and effective operationalisation of those values and expertise were critical to success through shared responsibility by team members for injury prevention. Not unlike the case study previously presented by Reid et al. (2004), in which different athlete care specialists (psychologists and lifestyle advisors) sought to better collaborate, Tee and Rongen (2020) study explored sports science, S&C and physiotherapy practitioners' ability to work together. Both studies acknowledge communication and inter-personal skills as essential for success and the high risk for conflict and competing goals (Reid et al., 2004; Tee and Rongen, 2020). In both cases, the training approaches between disciplines (e.g., care, ologist/science background) are similar enough that an integrated approach, where language and understanding are closely aligned could potentially exist. The risks however is that when practitioners use similar terminology and focus on overlapping areas, conflicts and misunderstandings may arise. In both Reid et al. (2004) and Tee and Rongen (2020) investigations there was a clear goal i.e., create an effective sports science sub system; reduce injury. What becomes apparent is there is an assumption that individuals can apply their individual expertise in synergy with others to deliver effective outcomes. A critical gap in our understanding of cross-disciplinary teams in sport is how practitioners *in silo* apply their craft as part of a team of practitioners towards these effective goals and outcomes.

2.2.3 Inter-disciplinary

As a metaphor, if a mono-disciplinary approach was thought of as consuming an individual fruit (banana; apple) it is distinct with its own appearance and flavour, multi-disciplinary could be considered a fruit salad, involving multiple disciplines working together, each contributing their unique perspectives while maintaining their distinct identities (Whitley et al., 2022). An individual can eat a single fruit or cut up elements of different fruits and consume them together, but in each case, the elements are separate and distinct. An inter-disciplinary approach might be thought of as a 'fruit smoothy' in which the fruits are blended, yet rather than elements that can be separated, the smoothy provides a new 'whole' which cannot be separated or isolated from the other constituent parts it has been mixed with (Whitley et al., 2022). This method entails a synthesis of perspectives from different disciplines, blending

them to create a cohesive understanding. Burns and Collins (2023), provide definitions in their scoping review and propose multi-disciplinary as a combination of several disciplines and methods (fruit salad) and interdisciplinary as the connection between, among and reciprocal collaboration (fruit smoothy). The study by Burns and Collins (2023) explores the evidence of collaboration in inter-disciplinary practice which underlines the issues of the use of interchangeable terminology in the literature and the generic use of the term inter-disciplinary team which they state, adds to confusion (Burns & Collins, 2023).

It seems that inter-disciplinary teamwork may exist in an academic/research-based paradigm rather than in applied sporting contexts (Buekers et al., 2017; Doherty, 2013; Piggott et al., 2020). Previously Buekers et al. (2017) argued that the combination and integration of information from different scientific disciplines seems to be important to better explain how elite performance comes about. Whilst the term is applied to a research question, the nature of inter-disciplinary team working in practice is poorly understood despite the terms widespread use. Piggott et al. (2020) attempted to understand the value of an interdisciplinary Vs. monodisciplinary approach on Australian Football League AFL sports performance. Applying Uni- Vs Multi- variate model analysis, they found that a more comprehensive understanding of sports performance can be obtained through an inter-disciplinary team (IDT) approach. Whilst the study by Piggott et al., (2020) champions the merits of IDT working, it is not how the practitioners work together rather the treatment of the data that they collect that is being reported, somewhat overlooking the need (or not) for collaborative teamwork. It might be that there is a tacit assumption of the need for (and adoption of) an inter-disciplinary approach in sport and yet what this looks like, how it plays out in practice and whether it is viable seem overlooked.

Burns and Collins (2023) in their recent scoping review highlight the need for high-performance sport teams to reflect on their working practices. The authors flag theoretical frameworks (such as programme philosophy), facilitative leadership and culture, organisational and logistical structures and processes and finally personal and interpersonal qualities of the team as key to understanding the nature of the work carried out in sporting contexts. Whilst the recent study by Burns and Collins (2023) provides useful definitions and scope for working practices of inter professional teams, there is still a broader (or deeper underlying) question of why and how these cross disciplinary teams enhance health and performance of athletes in sport collectively rather than by the sum of its parts (Tee et al., 2020).

2.2.4 Trans disciplinary

Interdisciplinary and transdisciplinary research performance and evaluation are both processes of harvesting, capitalising and leveraging multiple expertise (J. Klein, 2008). The recognition that in a 'knowledge economy' it is the integration and connection of diverse expertise that will generate new knowledge and help us to overcome some of the 'integrated knowledge domain' problems we face today (Vaughan et al., 2019; Woods et al., 2021). Where inter-disciplinary working is described as a 'fruit smoothy' in the metaphor, the trans discipline approach is described as a creating a new desert from the fruit smoothy base (Whitley et al., 2022), representing a unity of perspectives that transcends traditional disciplinary boundaries to generate novel insights. Burns and Collins (2023) describe trans disciplinarity as the blurring

of disciplinary boundaries, highlighting its potential to generate new lines of enquiry 'in-between, through, and beyond' traditional disciplines. They define it as operating 'across, beyond, and through' established frameworks, transcending and remaining unbound by disciplinary confines.

A trans-disciplinary approach in sports science moves beyond traditional disciplinary boundaries, fostering a more holistic and integrated understanding of performance, development, and behaviour (Vaughan et al., 2019). While trans-disciplinary research has gained momentum in fields like sustainability science (Brandt et al., 2013), its application in sport is increasingly recognised as essential for capturing the countless interactions between person and task within a situation (Vaughan et al., 2019). Advocates argue that traditional sport science research often studies phenomena through predetermined disciplinary lenses, defining, measuring, and analysing within established frameworks (Otte et al., 2022). In contrast, a transdisciplinary approach promotes a contextualised study of sport, unbound by disciplinary confines (Woods et al., 2021). It embraces a more narrative and abductive research process, where researchers engage with the phenomenon itself rather than imposing rigid conceptual models. The style of abductive reasoning opens new lines of enquiry, allowing for deeper insights into the ecological and behavioural complexities of sport (Vaughan et al., 2019; Whitley et al., 2022), ultimately leading to more innovative and applicable advancements in the field.

2.2.5 Department of Methodologies

The concept of a Department of Methodology (DoM) has been proposed to address the challenges of multidisciplinary teams (MDTs) in sport, where fragmented approaches can hinder effective athlete preparation (Otte et al., 2022; Otte et al., 2020; Rothwell et al., 2020). Proponents argue that traditional sport science disciplines often oversimplify the complex, dynamic nature of athlete development by using reductionist methods to quantify progress in isolated components (Rothwell et al., 2020). In contrast, a DoM aims to foster a transdisciplinary approach (Vaughan et al., 2019), integrating knowledge across specialist domains while maintaining the value of each individual discipline. By establishing a common conceptual framework, a DoM may enable greater collaboration among coaches and practitioners, attempting to ensure that expertise is applied in a more integrated and holistic manner. Specifically, the role of a DoM is to: (i) coordinate activity through shared theoretical principles, (ii) enhance communication by developing a unified language, and (iii) design practice environments rich in multi-sensory information to support the emergence of complex, sport-specific behaviours in athletes (Rothwell et al., 2020).

The current thesis, which advocates for greater integration among support staff, acknowledges the inherent challenges of different disciplines working collaboratively within a complex system. That said, the feasibility of a DoM and a transdisciplinary approach as practical solutions seems distant. Coaches recognise the importance of support staff and the value they bring to performance but express frustrations over their lack of accountability to the outcome (Burns et al., 2024), an issue that the DoM could potentially address. Furthermore, contemporary literature suggests a lack of clarity regarding how MDT practitioners operate with deeper investigations into the workings of these teams (Burns et al., 2024), crucially, there is a need to explore some of the assumptions as to why they need to in the first place. This

raises the question of whether inter, trans disciplinarity and DoMs are adding to a confused landscape or merely academic concepts that fail to align with the practical realities of sports environments. Perhaps, by better understanding of what unifies MDT practitioners and defining their collective purpose, we could more effectively leverage their expertise toward improved athlete outcomes.

2.3 Contemporary Issues

Attempting to understand team performance is not new and has been well researched (Salas et al., 2008; Salas, Fiore, et al., 2010; Salas et al., 2018). Much could be learned from this and the body of work from health care team science (Rosen et al., 2018; Walkenhorst et al., 2015; Zajac et al., 2021) and applied to sporting contexts (Stewart et al., 2024b). Yet, despite a substantial body of research available that explores effective teams, it's translation into sporting contexts appears haphazard. This is surprising, as anecdotally, sport is often seen as the gold standard for effective teamwork and relationship management. Sporting organisations may not always embrace research that could enhance support team performance and often face challenges in implementing new findings and practices within applied high-performance environments.

2.3.1 Risk and Influencing Factors on Team Performance

In a study exploring a practitioner's perspective on MDT working, Roncaglia (2016) acknowledged that little had been written or reported on barriers or risks that exist in MDT working. Whilst this research was conducted using health, education, and social care providers in the UK, the findings could well translate to sporting contexts. Risks and barriers identified in the paper were conflict between team members, communication, resource access, size of the team and accountability. Several success factors were suggested, one of which was establishing and agreeing aims and/or common goals (Roncaglia, 2016).

Those findings reported by Roncaglia (2016) are congruent with more recent papers exploring MDT approaches in sport that have had similar findings (Alfano & Collins, 2021; Alfano & Collins, 2023; Stewart et al., 2024a). Indeed, Salcinovic et al. (2022) identified this gap within the sporting literature and conducted a scoping review to identify factors that can influence team function and performance from other industries. The review identified four key areas (i) leadership style, (ii) supportive team behaviour, (iii) communication and (iv) performance feedback. Interestingly, the authors state that, to their knowledge, no evidence exists directly linking support team 'teamwork' to individual or team performance. However, indicators such as reduced injury rates and increased player availability suggest that such teamwork can have a meaningful impact (Salcinovic et al., 2022). This raises questions over what these teams do, why and how they establish what as a group they should attend to.

2.3.2 Evaluating Support Teams in Sport

Understanding the collective impact of the MDT on performance is challenging when considering the work of individual practitioners within their disciplines and that of the whole. Considering the breadth of services delivered across the MDT (performance, medical, psycho-social support), the ability to evaluate service support could be challenging. Stewart et al. (2024b) recently published a narrative review on the effectiveness of performance support teams (PSTs) in high-performance sport. The authors argue that 'MDT working' describes how a team functions rather than defining what the team is. Drawing on relevant PST literature, they examined key *inputs* including individual, team, and environmental characteristics, as well as *mediators* such as processes and emergent states, ultimately developing a conceptual framework for teamwork. This framework, the first of its kind for cross-disciplinary teams in high-performance sport, offers valuable insights for individuals, teams, and organisations. While the paper stimulates a broader research agenda on PSTs in sport and highlights factors contributing to effective teams, it overlooks the fundamental question of why these teams are needed and what their core purpose is when individual experts work together in teams.

2.3.3 Conceptual Challenges

From an empirical perspective, different terminology is applied to inter-professional team working in sport across the literature (Alfano & Collins, 2021; Burns & Collins, 2023; Stewart et al., 2024a). It should be noted that much of literature references 'how' we should approach scientific enquiry in sporting contexts (Buekers et al., 2017; Doherty, 2013; Piggott et al., 2020), not how cross-disciplinary teams serving health and performance of athletes functions or why. This under explored area is now garnering some interest in the literature. Alfano and Collins (2021) were among the first to begin to explore what 'good practice' looks like by Sports Science and Medical teams suggesting that little research has examined perceptions of the skills sets, process and mechanisms that lead to good practice.

2.3.4 Perceptions of good practice

How MDTs operate within their context and what defines 'good practice' when providing support to athletes and coaches was explored in a paper by (Alfano & Collins, 2021). Four themes were identified in this study that have implications for practitioners in practice including environmental appreciation, role appreciation, understanding people and the importance of team. Alfano and Collins (2021) state that understanding how an individual solves problems and make decisions effectively could be influential further commenting that we need to better understand the 'why, when and how' of delivery rather than what. Other relevant literature points to problem-solving and decision-making as either required or important to team performance without specifically qualifying what is meant (Alfano & Collins, 2021; Burns & Collins, 2023; Burns et al., 2024; Stewart et al., 2024a). It should be noted that an individual practitioner's decision-making and problem-solving may well look very different to when done within a multi-disciplinary context and given the nature of work these team carry out, this presents a significant area for further research despite the terminologies widespread use.

2.3.5 Determinants of Team effectiveness

It is acknowledged that research to better understand Performance Support Teams effectiveness in high performance sporting contexts is required (Stewart et al., 2024a). The authors apply a thematic approach to a series of focus groups where questions were asked to establish what makes these teams effective (Stewart et al., 2024a). Four overarching themes were generated that included team structure (composition, geographic dispersion, hierarchical arrangement, and leadership), team member attributes (role proficiency, open mindedness, adaptability, and humility), shared mental model (shared objectives, role understanding, and contextual awareness), and social capital (trust, respect, cohesion, and communication).

Like in the study conducted by Alfano and Collins (2021), Stewart et al. (2024a) explore perceptions of practitioners and leaders on elements of both good practice and effectiveness. The findings of which shed light on 'the how' of operating as part of a cross-disciplinary team but overlooks and even make assumptions over the why and the what. Across the literature on cross-disciplinary teams, conflict and disagreement within teams appears pervasive and a block on team effectiveness which raises questions over what the team are attempting to do and how.

2.3.6 Unanswered Questions

The assumption that individuals can and need to work through a team approach, that a team approach is in fact required and as Burns and Collins (2023) argue, that inter-disciplinary teams need to work collaboratively overlooks some significant questions that have not been explored through the literature.

(1) What are practitioners that work together in MDTs in sport attempting to do as a collective?
(2) Through the lens of the individual practitioners' skills and expertise, how are they applied through the cross-disciplinary team to be effective and why?

The following section explores elements of decision-making and problem-solving at the individual practitioner level.

2.4 The Individual Practitioner

In high-performance sporting environments there are different expectations placed upon practitioners. Practitioners are expected to be creative and innovative reflexively adapting to the dynamic contexts they work whilst finding new and novel solutions to complex 'wicked' (Vaughan et al., 2019; Walinga, 2017) performance problems (Nokes et al., 2009). Additionally, practitioners are trained to rely on rational 'objective based' analysis of data, unpacking readymade training interventions based on their specific discipline expertise (Collins et al., 2015). The literature differentiates between tame/simple, repetitive work

procedures and complex/wicked problems (Rittel & Webber, 1973; Schraw et al., 1995) where creativity and innovation are required to offer up new and novel solutions.

2.4.1 Dual systems and Intuition

At the individual practitioner level, decision making that supports these two styles of work require differing cognitive skills (Kitchner, 1983) dependent on the context, the task complexity within the situation, the time constraints and the levels of pressure, stress and anxiety involved (Alfano & Collins, 2023; Salas, Fiore, et al., 2010). Intuition (Kahneman & Klein, 2009; Klein, 2004), heuristics (Gigerenzer, 2004, 2008; Gigerenzer & Gaissmaier, 2011; Raab & Gigerenzer, 2015; Tversky & Kahneman, 1974) and fast 'system 1' thinking (Kahneman, 2011), which is fertilised with experience and expertise differs greatly from the rational, analytical, time consuming and slow 'system 2' component of dual systems theory (Kahneman, 2011). Across this continuum practitioners must continually weigh options and make decisions multiple times a day on a sub, semi, and fully deliberative basis (Lyle & Muir, 2020) drawing on their cognitive resources (Westbrook & Braver, 2015) to be effective and impactful. Dual systems theory suggests that in day to day life, most practitioners will likely rely on faster intuitive system 1 thinking over rationalising, there is however conflict in the literature as to whether this leaves individuals open to thinking errors and cognitive biases (Croskerry, 2003; De Martino et al., 2006) that lead to mistakes, or alternatively, expert intuition that gets to a 'satisficed' solution that is appropriate for the circumstance (Gigerenzer & Gaissmaier, 2011; Kahneman & Klein, 2009).

2.4.2 Problem-solving in sport

Problem-solving in science as defined through a simple google search is 'a question that you have that can be answered via an experiment.' Whilst this might feel intuitively correct, high-performance sport is not a research lab and athletes are not laboratory subjects on which experiments are carried out. Further, problem-solving or providing solutions suggests that practitioners working in high performance contexts face problems. Again, the dictionary definition of a problem is 'a situation, person, or thing that needs attention and needs to be dealt with or solved.' Whist anecdotally and through unchecked or poorly qualified use of the term in the contemporary sports literature (Burns & Collins, 2023; Stewart et al., 2024b), it is unclear what problems practitioners and teams face and whether there are considered processes or approaches to addressing them.

We have yet to establish the type of problems (Alford & Head, 2017; Schraw et al., 1995) that practitioners and teams face in high-performance sporting contexts and how they apply their cognitive 'repertoires' (knowledge, perspectives, and heuristics) to find and apply solutions (Page, 2014; Page, 2019). An individual's perspectives enable them to make sense of the world around them whilst heuristics (rules of thumb or cognitive shortcuts) enable them to interact with it (Mello & Rentsch, 2015). Everyone's perspectives are unique and idiosyncratic to them, whereas heuristics can be learnt and shared (Gigerenzer & Gaissmaier, 2011). It is important to note that heuristics can be either logical (Page, 2019) or ecological (Gigerenzer, 2004; Simon, 1990) and at times, will not work when applied out of their specific context.

We recognise that when faced with complex/wicked problems (Vaughan et al., 2019), teams are much more effective than individuals (Horwitz & Horwitz, 2007; Mello & Rentsch, 2015) and that basic procedural/checklist type methodologies will deliver sub-optimal or ineffective outcomes (Collins et al., 2015; Collins & Durand-Bush, 2015; West & Dellana, 2009). And yet much of the literature on what makes high performance teams effective focus on what constitutes a 'high performance' team (Salcinovic et al., 2022), team development practices (Edmondson, 2012) and interpersonal behaviours (Salas et al., 2008) that drive effective relationships. In sporting contexts through the lens of the multi-disciplinary approach, there is a distinct lack of research that seeks to understand the benefits, impact of, and approaches to effective team working. Moving past these basic questions, there is a need to explore what the processes and methods are that maximise 'integrated' MDT solutions to performance problem solving and what decision making underpins it.

2.4.3 Problem Solutions

Establishing the type of problems that practitioner teams face (simple or complex), their preferred methods for identifying and creating solutions, their subsequent execution of them and the processes that drive this needs exploration. How practitioners combine, integrate, and align their cognitive repertoires (Page, 2019) in working practice may offer insight into the 'how' of effective team working (Mello & Rentsch, 2015). An individual's abilities or 'repertoire' is made up of specific cognitive structures. Mental models are cognitive framework of internal representations that an individual uses to understand, interpret and interact with the world (Ashford et al., 2023; Salas, Fiore, et al., 2010), Perspectives, can be defined as the distinct ways in which a person makes sense of information, experiences and situations (Page, 2014) whilst heuristics are cognitive short cuts or a rule of thumb that enable us to interact with the world efficiently (Raab, 2012; Raab & Gigerenzer, 2015), and finally knowledge, that when combined within a group (Mesmer-Magnus & DeChurch, 2009), can create cognitive diversity (Mitchell et al., 2017; Mitchell et al., 2009). Important to recognise is that homogeneity reduces diversity and the impact that a diverse teams can deliver (Hong & Page, 2004). It has been documented that teams tend to be relatively homogenous and that both homophily and group think can significantly limit team performance (Page, 2014; West & Dellana, 2009). When teams are made up of people who think and act in the same way, come from similar backgrounds and rely on well established procedures and checklists to operate, it is unlikely that there will be a perceived need for novel problem solving approaches or a recognition of the benefits that diverse teams can offer (Page, 2019). When we consider the 'inter-departmental' models of MDT working and the vertical management and horizontal integration of MDTs across organisations, there is a risk that practitioners are unwittingly 'homogenised' and shaped to fit the required expectations.

In high-performance sport, perhaps the expectation (through the lens) of the institution, organisation, or team is that a practitioner has individual skills or 'expertise' that they apply within their discipline, delivering service as defined within a department. Alternatively, it might be that organisations leverage cognitively diverse MDTs to drive innovation and enhance problem solving. The potency of cognitive diversity on complex problem solving is well established (Page, 2007; Page, 2014; Page, 2019) and yet this area of research is underutilised in high-performance sport. Whether at the institutional, organisational or team level, the

correct climates (Proudfoot et al., 2007), behaviours and leadership exists to leverage true MDT working remains to be seen. In instances where it does exist, practitioners need the capacity to move beyond the limitations of the procedural processes that have been learned and have the interpersonal skills to enable the knowledge sharing, debate and disagreement that is needed to create better decisions (Milkman et al., 2009), solutions and innovations without the limiting effects of inter-personal conflict (Jowett, 2024; Reid et al., 2004). By better understanding of how practitioners approach their work as individuals and as part of MDTs, insight into how decisions are made and whether there is a perceived need for complex problem-solving in high-performance sporting contexts may be gained. By better understanding of this, an improved understanding of how to leverage the cognitive diversity that MDTs can provide may result in focusing the team on work that demands a collaborative approach.

By drawing on the contemporary literature of decision making, problem solving, creativity and innovation, MDTs, and teaming and by applying these concepts to high-performance sport, it may be possible to perform an analysis of (1) individual practitioners, (2) the teams in which they operate and (3) the organisations they operate within. If similarities or differences in how practitioners work in teams across different sporting contexts could be established, this may provide a significant offering to our understanding of MDT in high-performance sporting contexts.

Therefore, the objective of this thesis is to answer the overarching question: How do high-performance MDTs solve problems in high-performance sport? To answer the question, the role of MDTs in high-performance sport will be examined, focusing on their problem-solving and decision-making processes within high-performance environments. This research aims to is to explore how MDT practitioners in high-performance sport engage in problem-solving and decision-making and how leaders leverage MDTs to enhance their effectiveness in high stakes settings.

The study is guided by the following areas of exploration:

1. Practitioner Problem-Solving Approaches – Investigating how professionals operating within high-performance sport engage in problem-solving and decision-making within MDTs. This includes examining the cognitive frameworks, strategies, and methodologies employed to address performance challenges.

2. Barriers and Facilitators of Effective Collaboration – Identifying factors that either hinder or enhance effective collaboration within MDTs. This involves analysing interpersonal dynamics, organisational structures, communication strategies, and cultural influences that impact teamwork in high-performance settings.

3. Leadership and Decision-Making in MDTs – Exploring how leaders in high-performance sport leverage MDTs to enhance problem-solving and decision-making. This entails assessing leadership styles, strategic interventions, and decision-making frameworks that drive effective teamwork and performance optimisation.

It is hoped that by exploring the gaps identified in this review of literature findings will contribute to the existing body of knowledge on individual and team-based problem-solving in

high-performance sport. The findings may offer valuable insights for practitioners, coaches, and sports organisations on optimising MDT function to enhance decision-making, collaboration, and overall performance outcomes in high-performance environments.

Chapter 3: How do practitioners in high-performance sport approach problem-solving and decision-making within MDTs?

3.1 Overview

MDTs in high-performance sports comprise professionals from diverse backgrounds, including both performance and medical domains. Each practitioner brings a unique set of knowledge, skills, and expertise, yet how they conceptualise and execute their roles remains poorly understood. A critical aspect of their effectiveness lies in their decision-making and problem-solving abilities, collectively referred to as critical thinking skills.

Chapter three of this thesis aims to establish a comprehensive understanding of how individual MDT practitioners perceive and approach their work. It seeks to explore the cognitive strategies employed by practitioners in delivering their professional responsibilities, shedding light on the ways they think about and engage with their tasks. Additionally, the study presented in this chapter intends to identify the types of problems encountered in their work, as well as the problem-solving and decision-making approaches they apply. Furthermore, it examines the various methods and work approaches adopted by individual practitioners, providing a foundational insight into the diverse cognitive and practical strategies that shape their professional practice.

Findings indicate that practitioners employ a spectrum of cognitive strategies, adapting their approach based on the complexity of the problem. While they often rely on procedural expertise and intuitive decision-making for routine challenges, more complex issues require deliberate, rational problem-solving. By deepening our understanding of how individual practitioners operate, this research sets the foundation for examining the dynamics of MDTs further explored in Study 2. The work in Study 1 seeks to enhance the effectiveness of MDTs by clarifying how expertise is applied in real-world settings, meeting the aims and objectives presented earlier in Table 1, recaptured below.

	Study 1
Question	**Are MDT High-Performance practitioners skilled 'doers' or novel problem-solvers?**
Study Aim	– To understand the cognitive approaches and decision-making styles employed by MDT practitioners in high-performance sport.
Objectives	1. Identify cognitive approaches that are applied by practitioners to delivering their work 2. Identify problem types, problem-solving and decision-making approaches applied by practitioners in their work 3. Identify methods and approaches of work that are applied by individual practitioners
	See Table 1

3.2 Study 1: Multi-Disciplinary Team Practitioners Working in High Performance Sport: Skilled intuitive 'doers' or novel problem-solving innovators.

3.2.1 Abstract

Multidisciplinary Team Practitioners Working in High Performance Sport: Skilled Intuitive 'Doers' or Novel Problem-Solving Innovators

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ABSTRACT

Practitioners operating in performance sports are required to problem solve, enabling them to offer tailored performance solutions while making expert decisions with high precision. Problem-solving and decision-making are intertwined and tangled in practice. However, the reality is that practitioners require two independent skill sets. This study aims to investigate performance practitioner's approaches to problem-solving and decision-making, analysing the meta-cognitive skills required by multidisciplinary team (MDT) practitioners to be effective in their daily practice. Using a 71-statement Likert scale survey, 115 performance- and medical-related MDT practitioners were surveyed to gain insight into their strengths and perceptions of how they think about problem-solving and decision-making in their work. We tabulated descriptive data and created heat maps to visualise correlations between responses. Findings suggest that practitioners rely on a mixed bag of approaches, cognitively toggling between problem types, approaches, and decision styles. In this study, practitioners preferred skilled procedural doing and intuitive expertise to overcome simple problems over rationalistic, logical innovation to address complex problems. Findings suggest the need for MDT practitioners to differentiate between problem types, problem-solving approaches, and decision-making styles while deepening our comprehension of practitioners' expertise. It offers insight into the cognition that forms the foundation of their approaches, providing a valuable perspective.

Keywords: Critical thinking, decision-making, intuitive expertise, problem-solving.

3.2.2 Introduction

Sporting organisations covet practitioners who have critical thinking skills, the capacity to make effective decisions and the ability to problem solve whilst delivering highly specialised expertise and technical skills (Collins et al., 2015). For practitioners to be critical thinking problem solvers they require a cognitive repertoire of skills (Fiore et al., 2017; Mello & Rentsch, 2015) that extend beyond their ability to deliver with high technical proficiency. Delivering a series of empirically informed technical processes, procedures and checklists might neatly align with evidence-based protocols or skills learned through formative education however does the ends justify the means (Collins et al., 2015), and is simply doing what you know as a practitioner good enough? Alongside the 'doing' procedural based knowledge (Nokes et al., 2009) that practitioners possess, they are expected to apply this knowledge to situations in contexts that are unique, novel and require individualised and considered solutions. For this reason, the ability to apply cognitive skills to dynamic, environmentally derived problems becomes necessary and yet, to date, research exploring how practitioners think about how they work, what they do and why is slim.

Problem Solving Type (PST)

There are several approaches to problem solving classifications in industry that could be borrowed to extend our vocabulary in elite sport 'high performance support' contexts. Kitchner (1983) historically explored cognitive processing and defined a solution to a problem as either 'well' (singular guaranteed solution), or 'ill-defined*'* (multiple – nonguaranteed solutions). These solutions sit at opposite ends of a continuum in which the complexity within the problem increases as we move towards the ill-defined end (Schraw et al., 1995). Edmondson (2012) similarly reviews problem solving through a process-knowledge continuum where practitioners can engage in either routine or innovative operations where uncertainty of the outcome increases as we move towards more innovative solutions.

We must differentiate between tame/simple problems, those with an available, obvious, and tested solution and those that are wicked/complex (Childs & McLeod, 2013; Vaughan et al., 2019; Walinga, 2017), where the problem requires deep analysis, deliberation and the solution might not be effective and is certainly not guaranteed. The Cynefin Framework discussed by Greenberg and Clubb (2021) enables us to plot problems into quadrants of clear, complicated, complex, and chaotic based on levels of coupling between systems, processes and/or operations. When a problem is clear or complicated the solutions can be applied, tested and success measured. With complex and chaotic problems establishing clear solutions is a far more challenging endeavour due to the multifactorial nature of these types of problems and the interdependencies between systems, people, departments and/or organisations (Vaughan et al., 2019).

Much of the MDT practitioners work is previously thought to be informed through data, protocols and procedures either learned through specific technical training, research-based evidence or through practice (Hales & Pronovost, 2006). There is a dearth of applied training to prepare practitioners to work as part of a cross disciplinary team both through higher education courses and in professional training. The ability of a practitioner to integrate their skills and expertise into a multi-disciplinary approach to overcome complex problems is currently overlooked.   That said, practitioners are often expected to be able to solve complex

multifactorial performance problems quickly and efficiently. This requires solutions that might not sit within the processes that practitioners (or the team) deliver in their day-to-day work. MDT's having clear strategies to recognise problem types will enable them to consider whether a different approach is required.

Problem Solving Approach (PSA)

When a problem is 'simple/tame' it is likely that there is an obvious, ready-made solution that when executed will simply and quickly address the issue. Evidence based protocols, procedures, routines, and checklists all lend themselves to overcoming simple problems through structures that support, automate and speed up decision-making (Hales & Pronovost, 2006; Mosier & Skitka, 2018). Wicked or complex problems are sometimes defined as VUCA standing for volatile, uncertain, complex, and ambiguous (Johansen & Euchner, 2013). In the world of VUCA problems, no clear solution exists therefore novelty, creativity and or innovation are required to find an answer.

There may be multiple solutions available however addressing the ambiguous, ever-changing nature of the problem means that it is hard to judge whether any one solution is ever effective. Due to the integrated complexity and coupling that exist between elements of a problem, for example in sport, different professional disciplines working together, the various tools and skills at a practitioner's and team's disposal and all the variables that must be weighed and considered when making performance related decisions, there might be further unintended consequences to our actions. It is hard to see how affecting change at one point in the system, effects other inter-dependent elements (Rijpma, 2019).

Charles Perrow's Normal Accident Theory (Weick, 2004) argues that the greater the inter-dependency between systems and the tighter they are coupled, the more complexity exists presenting a greater challenge in identifying problems and exploring viable solutions to address them. With complex problems, the MDT needs to take stock of the problem, taking time to ensure they have identified the correct problem to be solved and that it is understood. Analysing problems, identifying contributing factors, considering systemic dependencies, and anticipating the unseen components make VUCA problem solving notoriously difficult. Set against the backdrop of the dynamic and reactive decision making of coaches (Collins et al., 2015; Lyle & Muir, 2020), practitioners are tasked with making good decision quickly and providing considered solutions with immediacy.

Decision Making Approach (DMA)

Practitioners often use the terms decision-making and problem solving interchangeably. It is important to differentiate between the process of problem solving and the act of choosing from a series of options i.e. decision making. These skills are intertwined often becoming tangled making it hard to differentiate between the decision, the problem and vice versa.

Types of decisions

Lyle and Cushion (2010) describes deliberative decisions as sub conscious, automated and happen without 'rationalisation' or awareness. Semi-deliberative decisions require a level of conscious choice where the practitioner will be aware of weighing decision options however,

the processes that underpin it are fast, tacit, and 'intuitive.' The final decision-making type is deliberative decision making (Kahneman, 2011). This type of decision-making requires time; it is slow, logical, and rational and requires the weighing of multiple options without time constraints (Kahneman, 2011). Humans must be able to make decisions in a variety of timeframes in different situations and contexts with magnitudes of constraints (Lipshitz et al., 2001) and varying levels of conscious awareness. Decision-making is well explored within the literature and recognised as an important differentiating characteristic of novice and expert practitioners and coaches (Lyle & Muir, 2020; Vergeer & Lyle, 2009). Martindale and Collins (2013) has convincingly argued that Professional Judgement and Decision Making (PJDM) is an important quality of expert coaches and practitioners. Through this research, we have extended beyond naturalistic decision-making (Lipshitz et al., 2001) research paradigms and lifted the lid on the cognition of decision making in sporting contexts.

Dual Systems Theory

Kahneman and Tversky's novel prize-winning work in the field of behavioural economics introduced the concept of Type 1 and Type 2 thinking styles (Kahneman, 2011). This body of work argues that humans can engage in fast, intuitive, energy conserving type 1 thinking but can also operate in deliberate, slow, methodical, and rational type 2 methods. System 1 enables us to operate and interact in the world without having to rationalise and purposefully weigh decisions. System 1 is fallible as it is reactive to our beliefs, emotions and is susceptible to cognitive thinking errors (Croskerry, 2003; Kahneman & Tversky, 1984; Tversky & Kahneman, 1974) and biases. Our Type 2 systems enable us, with the affordance of time, to problem solve, rationalise, and apply levels of logic to complex and unpredictable situations before deciding. Type 2 thinking is less susceptible to emotion but its energy hungry, saps our resources and depletes our cognitive capacities. System 2 is however inherently lazy and reluctant to be utilised favouring its reactive energy saving counterpart (Kahneman, 2011).

Performance sports organisations have moved towards being adopters of technology, innovation and data to gain competitive advantage or a performance edge. Sport practitioners are expected to engage with a variety of technologies, to be data informed and evidence led suggesting a reliance on rationalistic and logical decision-making approaches. However, the proliferation of data, the use of bespoke technologies and the inherently dynamic and reactive nature of decision making within the context of the moment raises significant challenges and pressures for practitioners. How confident or certain a practitioner can be in any one solution must be (at best) guess work when we consider how much information a practitioner and the team have access to and how much any individual can know and rationalise at any given moment (Gigerenzer, 2004).

The practitioner as a rational actor

The Nobel Prize winner Herbert Simon argued that humans are bounded in that they are fallible to thinking errors, emotional and limited in their ability to be both rational and to rationalise (Gigerenzer, 2008; Simon, 1966). The idea of 'unbounded rationality' still permeates our beliefs about how practitioners should operate in high performance elite sport and yet, practitioners must operate in complex environments, with complex interactions across a complex spectrum of hierarchical relationships with high stakes and under high pressure (Alfano & Collins, 2023; Simon, 1990). Practitioners need to have the ability to make decisions that are contextual and idiosyncratically derived (Gigerenzer & Gaissmaier, 2011). It turns out that as decision makers we satisfice, often selecting the 'best fit' or 'less than

perfect' solution that enables us to move forwards (Gigerenzer, 2008).   Optimising would suggest that practitioners can weigh all and every data point relating to a decision, calculate the correct option and make the optimum decision.   This view, when considered through the lens of our emotions, computational abilities, and socially derived contexts, make this unrealistic and in conflict with the expectations placed upon practitioners.

How do we cope with complexity?

Heuristics (Tversky & Kahneman, 1974), Speedy Heuristics (Lyle, 2010), Fast and Frugal Heuristics (Bennis & Pachur, 2006; Raab, 2012) can be thought of as cognitive shortcuts, rules of thumb or learned reactions that when applied allow practitioners quick response times with minimal draw on cognitive resources.   Heuristics have been shown to be highly effective in helping decision makers to make accurate decisions when weighing multiple options with or without time constraints (Gigerenzer, 2008; Gigerenzer & Gaissmaier, 2011; Raab, 2012; Raab & Gigerenzer, 2015).   Practitioners are encouraged to be evidence based and literature informed which steers much of their work towards unpacking procedural approaches and working through processes.   In practice, a practitioner needs to be agile to the ever changing and evolving demands placed on them by coaches, colleagues, athletes and the environment. There has been very little exploration to date of whether practitioners use heuristics and fast intuitive decision making in their practice.

Heuristics are thought of as adaptive and have been argued to be a key neural 'adaptation' that has enabled us to operate and interact within a complex world (Ullén et al., 2019). Heuristics are intricate knowledge bundles, comparable to compressed computer files. Once stored in long-term memory, they can be retrieved by working memory without decompression. Kahneman and Tversky (1984) led the systematic errors and cognitive biases programme and along with others (Blumenthal & Krieger, 2015; De Martino et al., 2006; Epley & Gilovich, 2006; McCloy et al., 2010) have discovered many heuristics and cognitive biases, both mathematical and situational (Gigerenzer & Gaissmaier, 2011).   Heuristics and their sometimes-unintended biases and errors appear to be part of our neurophysiology aiding and supporting learning, our ongoing development, and are a characteristic of our cognitive and neural apparatus (Sanfey & Stallen, 2015). They enable us to execute complex operations, carry out cognitive tasks, attend to multiple stimuli and execute skilled functions quickly and efficiently and are a characteristic of expertise (Larrick & Feiler, 2015) that sits within Type 1 dual processing theory of fast thinking mentioned previously.   There is no doubt that practitioners rely on fast heuristic style decision making within their practice due to the complex dynamic environments in which they work and consequently it would be reasonable to assume that it is a characteristic of their expertise (D. Collins et al., 2016; Lyle, 2010).

Skilled Intuition as trademark of expertise

Gary Klein has contributed significantly to our understanding of expertise (Kahneman & Klein, 2009; Klein, 1993, 1997, 2004) and has underscored the importance of observing decision makers in natural real-world contexts outside of a lab setting (Lipshitz et al., 2001).   Klein has observed military personnel, medics, paramedics, air traffic controllers and firefighters (Klein, 2004) to understand real world decision making in high stakes time pressured situations (Hotaling et al., 2015). What was initially thought of by some professionals to be a remarkable Extra Sensory Perception (ESP), has subsequently been investigated and better understood. Whilst the expertise of MDT practitioners is understood from their specific skills, service provision and intervention perspective, it is lacking in the cognition that underpin this. Given

practitioners must overcome problems and make a range of decision types both in the moment and in real time, Klein's work can shed light on a facet of the expertise of Practitioners working in sport.

Pattern recognition

Klein has been able to define and articulate expertise through both pattern recognition (Klein, 1993) and mental simulation (Klein, 1993, 2004). These skills enable practitioners in real time to observe, identify and recognise an unfolding scenario by extracting cues, triggers, and catalysts from the environment through cognitive mental structures called schemas and scripts instantaneously (Klein, 1993). These knowledge structures are built up through exposure, experience, and reflective practice (De Oliveira et al., 2014) and then when needed, can be accessed, and unpacked 'intuitively' by the decision maker without purposeful deliberation, rationalisation, or the benefit of time. Klein has been able to cast light over the tacit, rapid, and detailed computations of decision makers in high stakes situation and has also been able to show that this intuitive, recognition primed decision making (RPDM) is reliable in naturalistic setting and a vital component of fast decision making (Klein, 1993; Lipshitz et al., 2001; Lyle, 2010).

System 1, Intuition and Heuristics

Where Kahneman has argued against the reliability of fast system 1 thinking citing its fallibility to systematic cognitive thinking errors, biases, and mistakes (Kahneman & Tversky, 1984), Klein previously argued that intuition is a key requirement of skilled expert practitioners in the field (Klein, 1993). Bringing this academic debate closer to the realities of MDT practitioners operating day to day in sporting contexts; do practitioners utilise fast thinking, heuristics, and intuition within their individual discipline (Kahneman & Klein, 2009) relying on skilled intuitive expertise to provide unpackable solutions to simple problems? Alternatively, do practitioners leverage technology, data, and logic to identify complex problems, presenting precise solutions through purposeful decision-making models and problem-solving processes? Therefore the aim of this study is to examine the correlation between cognitive theories (PST and DMA) and the practices (PSA) of MDT professionals engaged in high-performance sports. The objective is to understand how practitioners in high-performance sports perceive and navigate their work and by doing so open new avenues for novel research.

3.2.3 Methods

Participants

For inclusion in the study individuals needed to be working in a professional capacity as part of an MDT in performance sport at either a development or senior level. A variety of MDT Practitioners (n=115) took part in the study (Table 2). Four (n=4) survey submissions were removed as they did not fulfil the participation criteria stated above and/or there were issues with the information provided in the submission resulting in (n=111) responses being analysed. A range of practitioners participated both from Performance (n=85) and Medical (n=26) related disciplines (Table 2). Additional information was gathered as part of the survey including the level that the Practitioner was working, the sport, their tenure in current role and overall experience level.

Instrument

A survey was designed to collect data on the views of MDT practitioners (Appendix C). The survey design utilised Likert scales to measure strength of perceptions on facets of problem solving and decision-making. The survey statements were evaluated and modified as required through initial review and through a piloting process. The survey was split into 5 sections with the statements distributed across them, the sections were split into (1) Problem Solving Type (PST), (2) Problem Solving Approach (PSA), (3) Decision Making Approach (DMA), (4) Data and Insight and (5) Climate and Team Working. A closing section asked whether participants would like to contribute to further elements of this research programme and were given the option to leave an email address. The statement responses were scaled as 1 – (Strongly Disagree) to 5 – (Strongly Agree). Each statement plotted across our 'cognitive styles' continuums as outlined. PST 1 – (Tame/Simple) to 5 – (Complex/Wicked); PSA 1 – (Procedural/Doing) to 5 (Creative/Innovating) and DMA 1 – (Fast/Intuitive) to 5 (Slow/Rationalistic).

Statements were worded such that in some cases responses needed to be inverted so for example, where a respondent rated:

My working day/week is made up of stable routines - 5 (strongly agree)

This score was inverted to 1 which then plotted to procedural doing in the analysis.

Procedures

The BAHSS Ethic Review Panel at the University of Central Lancashire granted ethical clearance to conduct this study (BAHSS2 0385)[4]. The survey was conducted online using Microsoft Forms®, meeting current GDPR requirements. Participants were recruited for the study through various routes. Initially, emails outlining the study expectations and eligibility were sent to individuals across several high-performance sport organisations asking them to distribute the survey across their workforce whilst a social media campaign using LinkedIn and Twitter also invited participation in the study. All participants were provided with information on the study methods and if eligible signed electronic consent prior to completing the survey. All data captured as part of this study was encrypted and stored on both the Universities secure network and an encrypted laptop computer.

Data Analysis

The data was exported from Microsoft Forms® and analysed in Microsoft Excel® and further analysed due to the size of the data set in Python using the NumPy (v 1.20.3) and pandas (v 1.1.4) packages for analysis, and Matplotlib (v 3.3.3) and Seaborn (v 0.11.0) for data visualization. Likert scale statements were grouped into three sets (PST, PSA, & DMA). Data were summarised as descriptive statistics (Table 2 & 3). Frequency analysis was conducted

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[4] The ethics approval form is presented in Appendix A

with the results presented as percentage of respondents and frequency count ([Figure 2](), [3](), [4]() & [5]()).

Heat Maps

Heat maps were created[5] to display the preferences of practitioners identified through their response values, specifically the joint distribution of the aggregated responses within each cognitive style set (Figures [2](), [3]() & [4]()). This has created a visual representation of practitioner's strength of perceptions. To build the heat maps each individual participant's response to a statement within a set was compared with their response to a statement from another in Python, we then counted the frequency of participant responses that were the same, for example how many times did participants both agree to each statement, how many times did they agree to the first but disagree with the second and so forth.

The heat map for a doublet (2 statement sets) was formed by plotting the responses in a grid and shaded according to the number of counts in each block. Where participants rated a response as a 1 or 2, these scores were grouped and was considered positive (or agreement), 4 or 5 were also grouped and was negative (or disagreement) and finally 3 was neutral creating our 9 blocks.

To create aggregated heat maps, we grouped statements that assessed characteristics of PST, PSA or DMA. As described above, for every combination of question pairs (PST n=28; PSA n=25; DMA n=25 statements) we summed the frequency of response permeations across all the statements in the two statement sets being compared. The sum of all these were processed and normalised by dividing the totals across all combinations (e.g., 28 X 25 X 111) to arrive at the aggregated heat map displayed in percentage values. The aim of taking this approach was to determine an estimate of the average joint distributions across the groups. We acknowledge that a heat map may enhance the ability to identify particularly strong and weak relationships. That said, we appreciate that what appears to be relational should not be interpreted as causative.

Root & Branch Result Tree

All statements were assigned into one of our three sets depending on whether they shed light on the PST, PSA, or DMA faced by practitioners. Each statement in a set is assumed an equal representative sample. This assumption means that we would expect respondents to be consistent in their answers e.g., if a respondent strongly agreed with statement that "The solution required when working with an athlete or team is usually obvious" then they would also disagree or strongly disagree with the statement that "I frequently have to find new solutions to be effective."

For each triplet of questions, one from each set, we mapped out the different response permutations e.g., PST is Tame/Simple, PSA is Procedural, and the DMA is Fast, and counted how many respondents fell into each. We summed the counts for each permutation across all unique triplets and mapped them across our root and branch figure ([Figure 5]()).

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[5] Heat map analysis is provided in [Appendix D]() and offers insight into the overall analysis conducted as part of this study. Note, by grouping Likert scales as outlined above, the heat maps presented in Figures 2, 3 and 4 are easier to interpret than as presented in the appendices.

3.2.4 Results

Table 2: The frequency of survey respondents by discipline and professional domain.

Discipline	Performance	Medical	Other	Total
Bio-mechanist	1			1
Coach	8			8
Doctor		1		1
Head of Athletic Development	1			1
Head of Medical		7		7
Head of Performance	25	1		26
Institute people and services lead[6]			1	1
Nutritionist	2			2
Performance Analysis	5			5
Performance Lifestyle	3			3
Performance Psychologist	1			1
Physiologist	1			1
Physiotherapist		11		11
Sports Science	10			10
Sports Therapist		5		5
Strength and Conditioning	28	1		29
Grand Total	**85**	**26**	**1**	112

There were 115 respondents to the survey of which 111 were analysed. 76.5% respondents were performance practitioners and (23.4%) were self-classified as medical related practitioners. Practitioners' characteristics ranged over sixteen disciplines. Strength and Conditioning (25.2%), Head of Performance (22.5%) and Physiotherapy (9.9%) were the highest represented in the study.

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[6] This survey response was removed from the analysis as it was not clear how this role works within the Multi-Disciplinary context.

Table 3: Practitioner Level, Sport Type, Tenure and Experience by Professional Domain

	Performance	Medical	Total
Level			
World Class Podium	21	8	29
World Class Potential	8	7	15
Talent Development	15	1	16
Senior/First Team	29	8	37
Academy	12	2	14
Sport			
Olympic/multi-Sport	41	12	53
Professional Team Sport	44	14	58
Tenure in role			
1<	19	8	27
2-4	43	8	51
5>	23	10	33
Overall Experience			
5<	12	6	18
6-9	21	8	29
10>	52	12	64

Practitioners taking part in this study are working at various levels of high-performance sport; Senior/First Team (33%); World Class Podium (26%); Talent Development (14%); World Class Potential (13%); and Academy (12%). Of the sample, 48% is working in Olympic or Multi Sport and 58% is in Professional Team Sports. A substantial proportion of practitioners completing the survey have been in their current role for 2-4 years (45%) with (57%) having accrued 10 or more years' experience**.**

Heat Maps

DMA – PST

Practitioners report a varied DMA whilst working with different PSTs. Practitioners rate making fast decisions whilst working with both simple (17%) and complex (16%) problems most frequently. 15% of practitioners agreed with statements where slow rational decision making was the preferred style whilst facing simple problems. 14% of responses accounted for logical rational decision making whilst working with complex or wicked problems. When summed, 26% of statements were rated as neutral.
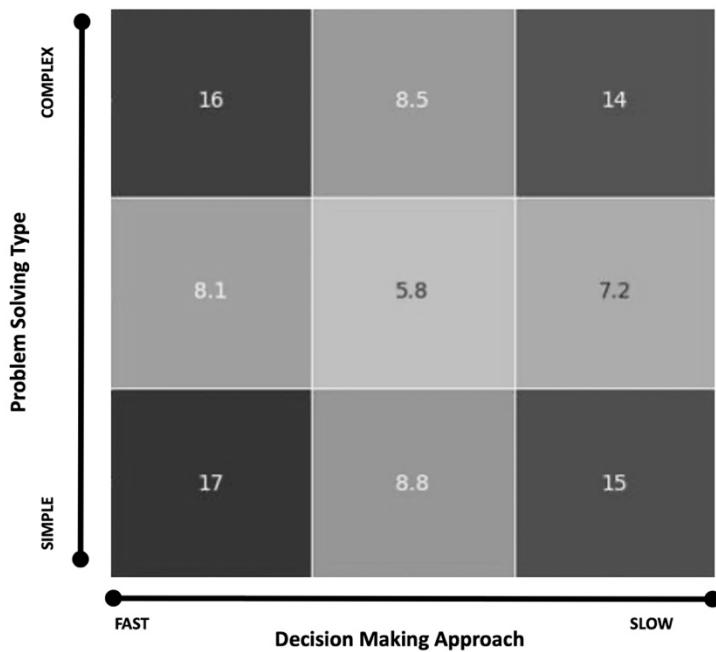
Figure 2: Heat map illustrating MDT Practitioners responses to Decision Making Approach (DMA) and Problem-Solving Type (PST) displayed as percentages (%)**.**

DMA – PSA

Statements regarding DMA were compared with Practitioners PSA. When making fast/intuitive decisions, practitioners preferred way of working was procedural/doing (18%) whilst others reported (15%) creative/innovating. When DMA was slow/rationalistic, 16% reported procedural doing whereas 13% worked creatively/innovating. When summed, those that reported neutral to DMA and/or PSA statements was 38%.
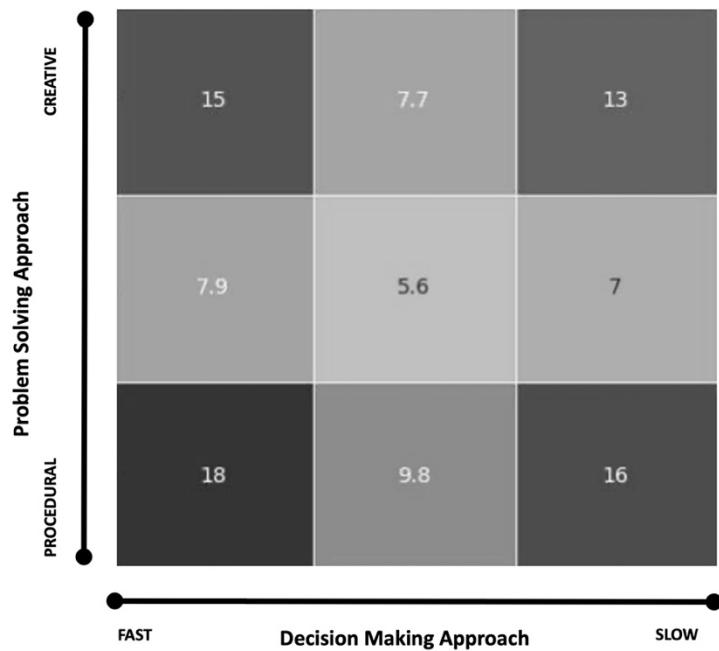
Figure 3: Heat map illustrating MDT Practitioners responses to Decision Making Approach and Problem-Solving Approach (PSA) displayed as percentages (%).

PST – PSA

Where practitioners (18%) rated working with tame/simple problems they had a procedural/doing approach, a further 14% of responses preferred creative/innovating with these types of problems. 17% of Practitioners working with complex/wicked problems reported a procedural/doing approach with 14% suggesting that creativity and innovating was required when facing these types of problems. 36% of responses were rated neutral across the heat map.
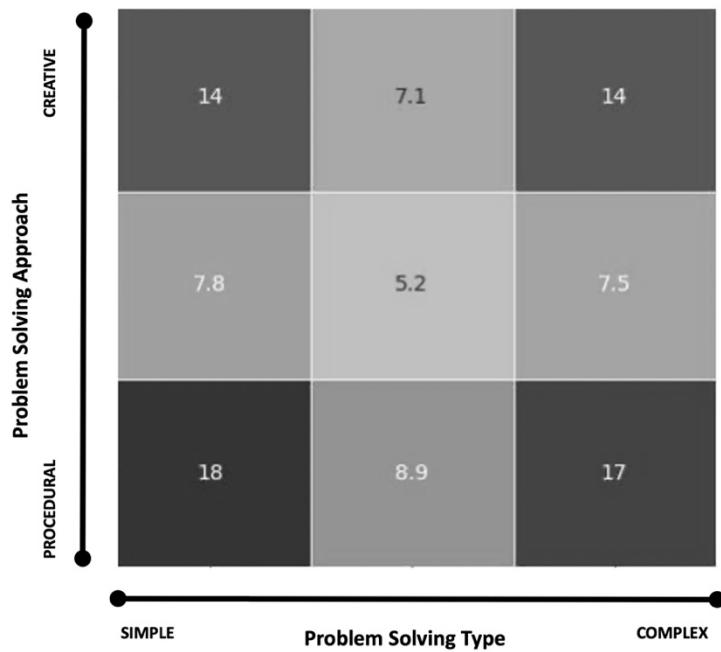
Figure 4: Heat map illustrating MDT Practitioners responses to Problem Solving Type and Problem-Solving Approach displayed as percentages (%).

How do Practitioners solve diverse types of problems?

Root and Branch Response Tree
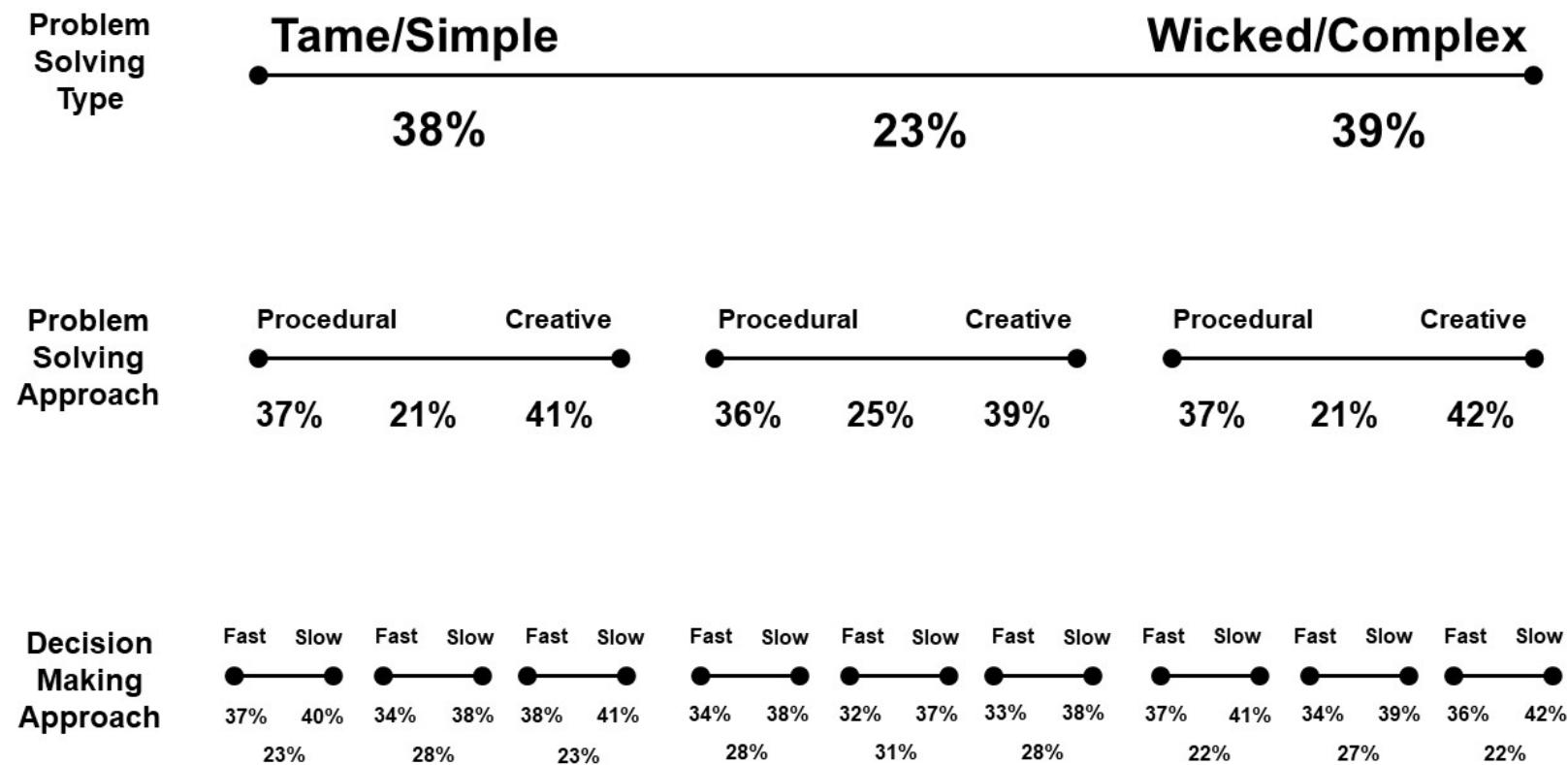
Figure 5: Root and Branch Response Tree illustrating percentage of how MDT Practitioners report thinking about how they approach their work gathered through the Likert Scale Survey responses.

Tame/Simple Problems

When the PST statements were aggregated, 38% had a tendency towards agreement with tame/simple problem types. Of those practitioners, 37% took a procedural/doing and 41% creative/innovating approach. Those that were procedural/doing appeared to make both fast/intuitive (37%) and logical/rational (40%) decisions where those that were being creative/innovating also made fast/intuitive (38%) and logical rational (41%) decisions. There was an average of 23.7% (+ or – 4.3-2.7%) who responded neutral to in PSA and DMA.

Complex/Wicked Problems

39% of practitioners tended to agree with statements that suggested complex/wicked problem-solving types. Of those, 42% and 37% took creative/innovating and procedural/doing approaches, respectively. Of the 42% of practitioners that took a creative/innovating approach, 42% reported towards logical/rational and 36% agreed with fast/intuitive decision-making approaches. Those that adopted a procedural/doing approach to complex/wicked problems appeared to make logical/rational (41%) decisions with 37% favouring fast/intuitive decisions. Those that rated neutral were again on average 23% (+ or - 4-1).

3.2.5 Discussion

The aim of this study was to examine the correlation between theories (PST and DMA) and the practices (PSA) of MDT professionals engaged in high-performance sports. The objective was to understand how practitioners in high-performance sports perceive and navigate their work through a Likert Scale survey. Practitioners working in high performance sport apply a range of cognitive styles and approaches to their work. This study shows differences in problem solving and decision-making styles and approaches in which no clear prevalent ways of working emerge. When we compared practitioners who work in different sporting contexts, professional disciplines and with different tenures and experience the picture was inconsistent. What emerged was a diverse array of cognitive approaches and methods, demanding toggling between simple and complex problems, procedural and creative approaches, and quick 'intuitive' versus deliberate decisions.

In each heat map DMA-PST (Figure 2), DMA-PSA (Figure 3) and PST-PSA (Figure 4), practitioners favoured simple problems-fast decisions, fast decisions-procedural work, and simple problems-procedural work, respectively. Although these were the highest scoring distribution pair responses, the results were equivocal. For a certain amount of a Practitioners daily work, they operate through processes, procedures, and protocols where they rely on technical skills and their intuitive expertise (Salas, Rosen, et al., 2010) to make fast 'in the moment' decisions selecting from an array of available 'heuristic' solutions. Depending on the practitioner and the MDT that they operate, the individual might be expected (or asked) to take on a broad range of tasks, some of which might sit outside their recognised scope of expertise. In asking practitioners to deliver against a broad remit for example, the sports scientist is also the strength and conditioning coach, nutritionist and an additional technical coach leading warmup, cool downs and managing drill intensities. Fractionated expertise (Kahneman & Klein, 2009) and limited time availability might stifle the practitioners' ability to move beyond simple-procedural delivery in favour of fast-available solutions and significantly dilute their

ability to solve complex performance problems because they lack both the expertise, the required cognitive diversity (Page, 2007; Page, 2014) and time.

In the current study, practitioners report working with both simple and complex problems. When compared to whether they make fast or slow decisions the picture is messy as in both cases fast decision making is slightly preferred to slow. This might suggest that practitioners rely on skilled intuitive expertise (Martindale & Collins, 2013) recognising what needs to be done through mental simulation (Klein, 1993) or prediction and acting with a level of automation. When the problem type is simple and the practitioner must apply slow, rational decisions it might suggest that they have less experience or limited expertise (Lyle, 2010) from which to draw on and yet, when compared by practitioner experience, there was no significant differences. It may be that there is an onus on Practitioners to utilise data and justify their methods and approaches and this is what comes through in the responses. If this is the case, then this will be either anticipatory, therefore drawing on skilled intuition or procedural knowledge (Nash & Collins, 2006; Nokes et al., 2009) to predict based on 'knowing' or retrospective, in that the justification is created through data visualisation based on what has happened (Milkman et al., 2009). Either way, this would suggest that practitioners rely on procedures, unpacking readymade solutions through pre-determined processes to familiar problems. This reinforces the need to provide experiential and problem-based learning (Gillette, 2011) opportunities for practitioners that are situated in applied practice.

The findings of this study would suggest practitioners appear to rely more heavily on procedural type problem solving approaches. Given the routine, process orientated nature of the work of MDT practitioners this makes sense. Working to schedules and through checklists and procedures would seem to suggest a level of automation in much of the work carried out (Collins et al., 2015). This style of working would hint at practitioners needing to be technically skilled doers over critical thinking problem solvers and yet, practitioners are required to be creative and do this both on the fly (fast) and in more planned and purposeful ways (slow). These slower styles of creativity may emerge to overcome training monotony where athletes have training fatigue and need a change of stimulus to pick them up or, when athletes are injured following phased return to performance and programmes and prescription needs more creativity and variation.

There is no doubt that changes to an athletes training routines and schedules due to (for example) transitions in season, fatigue, under performance, fixture congestion, training monotony or injury could be considered either simple or complex problems to overcome depending on the practitioner or MDTs perspective. It was noted that Practitioners still favour procedural based approaches to what they report as both simple and complex problems. This would suggest that practitioners work in a process of 'doing' following procedures and protocols that align with both how performance sport tends to operate (i.e. through routines and schedules) and how practitioners are trained (i.e. through procedural knowledge and technical skills).

Where Practitioners face complex problems, we might expect to see them generate novel or innovative solutions to overcome them (Fiore et al., 2017). In some cases, this was reported and is to be expected especially if problems are truly complex and difficult to solve (Nokes et al., 2009). Where problems are simple and yet creativity is applied this might suggest the practitioner has a level of freedom, lower risk in deploying different strategies or low accountability to the result (Proudfoot et al., 2007). Practitioner deploying creative/innovative

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solutions to simple problems when routines and process must be followed might suggest a high-risk strategy. It is much harder to predict the outcome when deploying novel solutions (Page, 2014) in predictable training environments where results are demanded. It might be the case that practitioners have low 'objective' accountability to show impact within their performance processes. Regardless, it is imperative that practitioners, MDTs or those that lead them take time to initially consider the problem type, problem solving approach and how they intend to overcome them. Afterwards and throughout, review and reflection will offer insights on the effectiveness of the approach and outcomes.

When we analyse the triplet 'root and branch' cognitive styles tree ([Figure 5](#)) the picture that emerges is one where practitioners are required to cognitively toggle between different problem-solving types, problem solving and decision-making approaches. In tracking the practitioner's responses hierarchically and through discrimination via PST we can see how practitioners report approaching problems and then their decisions. We asked Practitioners to remain zoomed out when responding to the Likert scale statements and not zoom in to specific examples or events. This was an effort to get a broad sense of how practitioners think about approaching their work. [Figure 5](#) tracks (across the continuums) how the individual practitioners report working with simple or complex problems.

Of note, across each of the continuums the pattern that emerges is similar. There appears to be a split across the practitioners between simple and complex PST that they work with, a pattern that follows through each branch of PSA and DMA continuums. Where problems are simple there is a split between procedural and creative problem-solving approaches that then equally split again between fast and slow DMA, this is almost mirrored when we follow those practitioner responses who favoured the complex PST. This would suggest either that practitioners do not have strong consistent ways of working and approaches to their work or that they work in highly dynamic environments where one cognitive styles approach is not adequate for all eventualities. An alternative consideration would be that Practitioners do not apply or are not aware of the metacognitive approaches that they could deploy across their practice that would enhance both their processes and rationales (Kitchner, 1983). Final considerations might be to acknowledge the environment and its climate (Proudfoot et al., 2007), the organisational structure and how practitioners are expected or instructed to work. In each of these cases, there could be rigid or flexible structures, low or elevated levels of freedom and weak or strong processes and procedures all of which would influence how a practitioner approaches their work.

Limitations

Effort was made to match the Likert scale statements to the behaviours we were looking to assess across the survey. With any Likert scale survey there is a risk of acquiescence bias (Winkler et al., 1982) in which fast clicking, a lack of attention to the question being asked by the respondent and unintended bias in how the statement is presented by the researcher can skew the results. The survey captures a general sense of how practitioners think about and approach their work, which is what we set out to achieve, and yet we must be aware that further investigation is required to understand the nature of a practitioner's work across the breadth of their role and their approaches to this.

3.2.6 Conclusion

The objective of this study was to unravel the interwoven aspects of problem solving and decision-making, aiding practitioners in consciously applying critical thinking and their cognitive skill set with precision when tackling daily challenges in their practice through a survey-based approach. We sought to verify whether critical thinking and performance problem solving are imperative in high-performance sports. We wanted to understand whether practitioners differentiate between Problem Solving Types (PST) and purposefully deploy diverse Problem-Solving Approaches (PSA) or if they primarily rely on intuitive, heuristic-based methods grounded in expertise. Additionally, we explored whether performance sport professionals function as creative innovators, employing logical reasoning to devise novel solutions for challenging problems.

What emerged was a diverse array of cognitive approaches and methods, demanding toggling between simple and complex problems, procedural and creative approaches, and quick 'intuitive' versus deliberate decisions. This study prompts reflection on the metacognitive skills essential for practitioners to excel in performance sport environments and challenges the narrative that sporting organisations require problem solving 'data driven' innovators. The findings would imply that scenario and problem based experiential learning approaches acquired through applied practice and purposeful reflection is critical to the development of the intuitive expertise of practitioners.

3.2.7 So what…?

- Practitioners in high-performance sporting contexts face a range of problem types and problem-solving approaches in their work.
- Practitioners rely on skilled 'intuitive' expertise adopting fast, heuristic-based semi-deliberative decision making and leverage more rationalistic, logical based approaches.
- When problem type, problem solving approaches and decision-making approach are detangled, no clear, compelling picture of how practitioners work emerges suggesting practitioners must toggle between cognitive styles and skills.
- Practitioners could benefit from developing meta-cognitive strategies to differentiate and discriminate between their critical thinking skills and apply them purposefully based on the environment, context and need

3.3 Practical Implications

- Enhanced decision-making training will increase practitioners' awareness of intuitive 'heuristic' type decisions and more rationalised approaches.
- By developing scenario-based learning opportunities, practitioners will develop their RPD and intuitive type decisions recognising cues and triggers from the context and enabling them to make effective decisions quickly.

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- Foster creativity and flexibility to enable practitioners to generate novel solutions to complex problems.
- Support practitioners to develop metacognitive strategies so that they can recognise when different decision-making and problem-solving approaches are required.
- Developing practitioners' reflective practice on their cognitive approaches will enable them to develop insights on their decisions and problem-solving capability enhancing their capability.

3.4 Summary Infographic (Study 1)

STUDY 1: Multi-Disciplinary Team Practitioners Working in High-Performance Sport: Skilled intuitive 'doers' or novel problem-solving innovators.

Key findings — 71 statement likert scale survey completed by 111 high performance sport practitioners

Diverse Cognitive Approaches:

Practitioners in high-performance sports use a range of cognitive approaches and methods. These approaches vary between simple and complex problems, procedural and creative methods, and quick intuitive decisions versus deliberate decisions.

Intuitive vs. Deliberative Decision-Making:

There is a heavy reliance on intuitive expertise and heuristic-based, semi-deliberative decision-making. However, rationalistic, logical-based approaches are also leveraged depending on the situation.

Procedural Problem-Solving:

Practitioners predominantly employ procedural problem-solving methods due to the routine, process-oriented nature of their work. However, they must also exhibit creativity, particularly when overcoming training monotony, athlete fatigue, or injuries.

Need for Metacognitive Skills:

The study highlights the necessity for practitioners to develop metacognitive strategies to better differentiate and apply their critical thinking skills based on the environment and context.

Flexibility in Cognitive Styles:

Practitioners must toggle between different cognitive styles and skills due to the dynamic environments in which they operate. There is no single cognitive style or approach that is adequate for all situations.

Practical Applications for Elite Sports Practitioners

Enhanced Decision-Making Training

Develop training programs that focus on both intuitive and deliberative decision-making skills. This can help practitioners toggle between quick, heuristic-based decisions and slower, more analytical approaches as needed.

Scenario-Based Learning

Implement scenario and problem-based experiential learning approaches. These methods, combined with applied practice and purposeful reflection, can help develop the intuitive expertise necessary for high-performance environments.

Foster Creativity & Flexibility

Encourage a culture of creativity where practitioners are allowed to experiment with novel solutions, particularly when dealing with complex problems. This can help in adapting to varying challenges such as training monotony, athlete injuries, or performance slumps.

Develop Metacognitive Strategies

Train practitioners to develop metacognitive strategies that allow them to assess and apply their cognitive skills purposefully. This involves understanding when to switch between different problem-solving and decision-making approaches based on the specific demands of the situation.

Reflective Practice

Promote reflective practices among practitioners. Regular reflection on their approaches and decision-making processes can provide insights into what works best in different scenarios and help refine their problem-solving skills.

Practitioners don't work in **isolation**. They work as part of an **MDT** and must attend to **complex problems**. How do practitioners operate as part of an MDT?

Study 2...

Figure 6: Summary Infographic of Study 1[7].

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[7] An infographic was created to provide feedback to those who took part in the study and to share on social media. This is presented in Appendix E

3.5 Link to Study 2

Linking Practitioner Approaches and Collaborative Problem-Solving in Multi-Disciplinary Teams

The current research aims to deepen our understanding of how MDT practitioners approach their work, particularly in high-performance sports contexts. The first study focused on identifying the cognitive and procedural strategies (Kahneman & Klein, 2009; G. Klein, 2008) that practitioners employ when dealing with different types of problems, ranging from simple to complex. The results revealed a diverse array of practices, with practitioners reporting that they engage with both simple and complex problems in their work.

3.5.1 Study 1: Understanding Practitioner Approaches

The findings of the first study (summarised in Figure 6) suggest that MDT practitioners exhibit a slight preference for working with simple problems, often relying on procedural, routine-based methods and making quick decisions. This tendency toward fast, intuitive decision-making (Kahneman, 2011) indicates a reliance on heuristic expertise (Kahneman & Klein, 2009). However, this finding is not uniformly observed across all practitioners, highlighting variability in how different individuals approach their work.

Sports Science and Medical practitioners, with their distinct professional training, skills, and expertise (Ericsson et al., 2007), naturally gravitate towards routines and procedures, particularly when operating within their evidence-based, empirically driven professions (Sackett et al., 1996). For instance, a Strength and Conditioning (S&C) Coach must follow deliberate, extended processes to develop certain physical qualities in athletes, ensuring the necessary adaptations occur. Similarly, a physiotherapist guides an injury back to health over the time required for tissue healing and repair, following protocols informed by clinical research. In these scenarios, the practitioners' approaches are deeply rooted in protocols, processes, and routines, which are critical to their professional training and the predictable nature of the challenges they face. Within this approach, there is little space for practitioners to apply their skills in novel or innovative ways.

3.5.2 Implications for Collaborative Work

The dynamics change when practitioners work within MDTs, where collaboration is essential for success. High-performance sport environments often involve complex, multifaceted problems that require innovative solutions (Cruickshank & Collins, 2012). The first study highlighted that while practitioners may feel confident operating within their discipline's silo, solving problems within a team setting often demands a different approach (Van Knippenberg et al., 2004). Research suggests that cognitively diverse teams, such as MDT, are better equipped to tackle complex problems than individuals working in isolation (Page, 2007). This shift from individual to team-based problem-solving introduces the need for cognitive flexibility (Kozlowski & Ilgen, 2006), as practitioners must adapt their methods to collaborate effectively and generate novel solutions.

3.5.3 Future Directions and Exploration of MDT Collaboration in Study 2

Building on insights from Study 1, the second investigation in this thesis seeks to explore MDT practitioners' perspectives on working collaboratively as part of a team (Salas et al., 2008). While individual practitioners may excel in their specialised domains, they are not always trained to apply their skills within an integrated, team-based approach. Edmondson (1999) discusses how psychological safety influences team collaboration and learning. By gathering insights from practitioners in the field, Study 2 aims to uncover how they perceive and engage in collaborative work identifying barriers and facilitators to this within the sporting context.

Additionally, Study 2 will examine what practitioners believe problem-solving and decision-making look like in real world high-performance contexts (Klein, 1997). Particularly Study 2 will explore how practitioners think about and approach collaboration, problem-solving, and decision-making especially in environments that demand nested critical thinking and metacognitive skills (West & Dellana, 2009). By building a picture of these processes, the study aims to identify potential gaps in our understanding and approach to these concepts within MDTs.

Collectively studies 1 and 2 therefore aim to enhance our understanding of how MDT practitioners navigate the complexities of high-performance sports environments. The contrast between individual and collaborative problem-solving approaches underscores the importance of cognitive flexibility (DeChurch & Mesmer-Magnus, 2010) and the need for practitioners to adapt their methods when moving from isolated work to team-based settings.

The insights gained from these studies have the potential to inform training, practice, and future research in the field, particularly in developing interventions that enhance collaborative decision-making (Edmondson & Bransby, 2023) and cognitive flexibility (Kozlowski & Ilgen, 2006) within MDTs. By better understanding how practitioners operate both individually and as part of a team, we can improve the effectiveness of MDTs in high-performance sports and beyond.

Chapter 4: What are the barriers and facilitators of effective collaboration within MDTs?

4.1 Overview

Chapter 4 explores the dynamics of MDTs within high-performance sport, highlighting both their potential benefits and inherent challenges. While technical expertise is highly valued in these environments, the ability of practitioners to collaborate across disciplines is often less understood. The study presented in this chapter examines how practitioners integrate within MDTs, drawing insights from focus group discussions with 28 professionals across various sporting organisations.

The second study in this thesis aims to investigate the roles, functions, and operational dynamics of multidisciplinary team (MDT) practitioners within high-performance sports settings. It seeks to identify what practitioners do and how they function as part of an MDT, highlighting the key tasks, responsibilities, and interactions that define their work. Additionally, this study will explore the barriers and facilitators that influence effective MDT collaboration, providing insight into the factors that enhance or hinder team performance. A deeper understanding of practitioners' experiences in working within an MDT will be developed, focusing on their perspectives on teamwork, collaboration, problem-solving, and decision-making processes. Study 2 aims to provide a comprehensive view of the challenges and opportunities faced by MDT practitioners in high-performance sport.

The research identifies key functions of MDTs; decision-making, collaboration, interpersonal development, and leadership, while also uncovering the nuanced factors that influence their effectiveness. Findings suggest that while diversity within teams enhances problem-solving and decision-making, it can introduce complexities that hinder efficiency. Additionally, psychological safety, role clarity, and adaptability emerge as critical components for successful teamwork.

Through this exploration, the chapter provides a realistic perspective on MDT operations, contrasting the idealised vision of seamless collaboration with the realities practitioners face in high-pressure environments. The insights presented aim to inform best practices for optimising teamwork in high-performance sports settings. The work in Study 2 seeks to enhance the effectiveness of MDTs by identifying challenges and facilitators to effective MDT collaboration, meeting the aims and objectives presented earlier in Table 1, recaptured below.

Study 2	
Question	**What do practitioners do and how do they operate as part of MDT in high performance sport?**
Study Aim	– To identify the challenges and facilitators of effective MDT collaboration in high-performance sport environments.
Objectives	1. Identify barriers and facilitators to effective MDT working 2. Understand the experiences of operating as part of an MDT by practitioners 3. Explore the experiences of practitioners in collaboration, problem-solving and decision-making when working as part of an MDT

4.2 Study 2: Multi-Disciplinary Teams in High Performance Sport, The What and The How: A Utopic View or a Darker Reality

4.2.1 Abstract

Multi-disciplinary Teams in High Performance Sport, The What and The How: A Utopian View or a Darker Reality

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Abstract

High performance sport practitioners work as part of a cross-functional team of experts to deliver effective service to coaches and athletes. While practitioners' technical skills are highly coveted, their ability to work within a team of experts from different disciplines is poorly understood and researched in sporting contexts. Success or failure of practitioners is often the by-product of their ability to integrate into the team and maintain relationships under high pressure and in challenging environments. The objective of this study was to explore how practitioners work as part of multi-disciplinary teams (MDT) in high performance sport. Twenty-eight practitioners from different professional disciplines and sporting organizations attended five separate, virtually hosted focus groups where the researcher and participants shared their views, beliefs, and perspectives about how they approach, and what they think about when working, in MDTs. Responses were analyzed using a qualitative reflexive thematic approach, and a thematic map and four themes were identified to depict what MDTs do and how they operate. The four domain topics (the "what") were (1) Decision Making & Problem Solving; (2) Collaboration & Knowledge Sharing; (3) Interpersonal Skills & Development and (4), Leadership & Team Dynamics. The four themes for how practitioners operate (the lubricants of successful MDT working) were (1) Cognitive diversity is important but not if it slows us down, (2) Staying in your lane is encouraged however sharing and collaboration is important (3), We need psychological safety, however poor behavior keeps getting in the way, and (4) High confidence in a world of nuance and uncertainty; adaptability and context is key. The thematic map presents an idealized perspective of how practitioners' function within MDTs in high-performance sport. This utopian view contrasts with the reality that practitioners face. Their frustrations, challenges, and reflections stemming from failures paint a darker picture of their experiences, highlighting the complexities inherent in their work and flagging considerations for both practitioners and leaders.

4.2.2 Introduction

Practitioners from different specialist professional domains work together and with coaches to form cross-functional Multi-disciplinary Teams (MDT) (Reid et al., 2004). These MDTs provide service and cross-functional problem-solving capability to support athletes and teams to achieve optimized outcomes in the pursuit of excellence. While MDTs are now commonplace in sport (Burns & Collins, 2023), there is still limited research investigating how MDT practitioners operate in practice across professional domains (Alfano & Collins, 2023) which creates a gap in our understanding of what effective teams look like (Salcinovic et al., 2022). There is, however, a strong research base exploring the effectiveness of different types of cross-functional teams (Salas et al., 2008) across both different professions; for example, healthcare (Rosen et al., 2018) and across different contexts. Indeed, Zajac et al. (2021) highlights the potential benefits of MDTs in healthcare professions yet notes working with team members from different backgrounds can be challenging, and practical barriers to teams reaching their potential do exist. The creation of research that seeks to bridge the gap between MDT approaches in different professions with that of elite sport could further enhance how teams from different professional backgrounds blend their expertise and skills to deliver integrated and aligned service in high-performance contexts.

Burns and Collins (2023) in a recent scoping review of 22 articles identify four key themes from performance support teams literature. These were theoretical frameworks, facilitative leadership and culture, logistical structures and processes, and personal and interpersonal qualities. Recently, King et al. (2024a) assessed the strength of perceptions of practitioners on how they approach their work. Findings showed that practitioners face different types of problems, approach solving them in different ways, and utilize different decision-making styles. The study opened opportunities to further investigate MDT practitioners with specific focus on how they operate as part of MDTs and what they attend to. This seems pertinent given the complex nature of practitioner's work and the demands and expectations placed on them by coaches, athletes and sporting organizations (Wagstaff et al., 2015). Some literature explores various aspects of MDT work, as highlighted in Burns and Collins (2023) scoping review. However, a gap remains in understanding what practitioners *actually do* and how they *conceptualize* working within an MDT, particularly when it comes to problem-solving. Assuming that practitioners inherently know how to collaborate effectively within such teams, and treating this knowledge as "taken for granted," risks undermining both individual and team capabilities. Drawing upon those findings and the broader literature, we have created four statements/assumptions about how MDT practitioners operate in applied contexts acknowledging that elite sporting contexts are highly unique.

Statement 1: Practitioners work in teams with colleagues from different professional backgrounds.

Multi-disciplinary practice is a well-established approach in professional domains such as the medical (Seckler et al., 2020) and healthcare (Leeftink et al., 2020) industries where a significant body of research has been developed (Momsen et al., 2012; Walkenhorst et al., 2015). In professional sport, multidisciplinary teams (MDTs) are considered a standard operating practice (Reid et al., 2004), yet confusion and disagreement persist regarding the terminology used by both MDTs and sport leaders. Terminology such as mono-disciplinary,

interdisciplinary, transdisciplinary (Vaughan et al., 2019) and, more recently, department of methodologies (Otte et al., 2020; Rothwell et al., 2020) are used across industry and research with similar issues cited in the healthcare literature (Martin et al., 2022). There is a desire to adopt language that reflects the nature of a cross-functional team's approach, accurately describing the type of work they do, and yet, in sport, we have not been able to articulate how MDT practitioners effectively work together (King et al., 2024a).

Practitioners typically hold undergraduate and post-graduate qualifications, have professional qualifications, and are registered with a professional awarding body (Alfano & Collins, 2023). Throughout the years of education and training that a practitioner receives, limited time or attention is given to how their professional skills and expertise (Collins et al., 2015) work in combination with colleagues from other disciplines (Bartlett & Drust, 2021). In the main, practitioners are trained to deliver hard technical skills and evidence-based approaches and methods within their scope of practice (Collins et al., 2015). This poses the risk of creating a workforce of highly qualified practitioners whose knowledge remains inaccessible, whose deep expertise does not translate effectively into practice, and who are compelled to work strictly within their professional boundaries and in isolation. Consider a physiotherapist and doctor discussing clinical treatments for a complex shoulder or knee injury and seeking (or not) the views of the Strength and Conditioning (S&C) coach on relevant testing and monitoring diagnostics across a graded Return to Play (RTP). Each profession has its own domain knowledge, language and skills (Burns & Collins, 2023) that might not translate across disciplines, making it less accessible than we might think at first.

Statement 2: Practitioners who work in MDTs work together to solve complex problems and make difficult decisions.

Practitioners work with colleagues from different backgrounds and departments to solve performance problems and help bridge performance gaps (Bartlett & Drust, 2021; Woods et al., 2021). This requires a blend of cognitive and applied skills to understand the nature of the problems and then apply solutions that solve them. Problems faced by MDTs in sport are volatile, uncertain, complex and ambiguous (VUCA) (Wilson et al., 2024a), chaotic (Vaughan et al., 2019), or wicked (Greenberg & Clubb, 2021; Rittel & Webber, 1973). When more people are involved with the problem, a greater number of departments or divisions and a greater number of interacting "seen and unseen" variables come into play, the more complex the problem becomes and the harder it is to find clear, simple, and testable solutions (King et al., 2024a). It is likely that the very nature of MDT practitioners working together increases system complexity (Hong & Page, 2004) that in turn makes it harder to solve performance problems, yet cognitively diverse teams have been shown to create better solutions (West & Dellana, 2009) to complex problems than individual ability alone in other professional domains (Page, 2007, 2019).

As well as making decisions, practitioners are expected to provide advice to athletes, coaches, and colleagues to aid in their decision-making. Much of the work that practitioners deliver is through intuitive expertise (Kahneman & Klein, 2009; Klein, 2004; Salas, Rosen, et al., 2010), procedures and protocols (King et al., 2024a) where they follow recipe-like checklists to deliver within their service domain. This type of process-orientated, fast decision making (Kahneman, 2011) and skilled doing (King et al., 2024a) does not require rationalized, logical, and considered decision making associated with complex problems where solutions are hard to find and difficult to solve (Kahneman, 2011; Kahneman & Klein, 2009). Where there are several departments providing service to athletes and coaches (consider for example, Return to Play

(RTP) immediately following injury or total training load monitoring to support a taper and peaking strategy), each department may hold insight that in isolation will only contribute to part of a picture. Analysis, discussion, and debate within the MDT, where some form of consensus of decision-making is required, is at times the only way to continue to keep moving forwards (Tee et al., 2020).

Statement 3: Practitioner teams possess diverse skills and expertise that create better solutions than could be established in isolation.

Providing "mono- or multi-disciplinary" (Otte et al., 2022) process-orientated services in isolation can deliver results to a point. Consider a physiotherapist managing an injury back to health, a Strength & Conditioning Coach (S&C) developing a physical quality relevant to performance, a nutritionist assessing body composition and providing a detailed nutrition plan, or a performance bio-mechanist producing a race/game model or real time feedback on race execution. Practitioners can deliver in isolation, yet this would seem disjointed and a missed opportunity. At times, combinations of skills can deliver far better outcomes (Alfano & Collins, 2023; Page, 2014). Practitioners leveraging broader perspectives through other team members can help generate insight that otherwise would not be visible (Burns & Collins, 2023; Stewart et al., 2024a). For example, the nutritionist's and S&C coach's isolated goals might not be mutually agreeable and could lead to conflicting training aims. Yet, a conversation most likely facilitated by the leader of the team or a coach between the practitioners could enhance the ability of the athlete to achieve the physical goal while influencing body composition. Both practitioners could then engage the analyst to help them identify why the physical quality and a certain fat-free mass composition could determine a performance outcome. Finally, the S&C coach could help the physiotherapist objectify some baseline Return to Play (RTP) measures by sharing relevant objective data that may help inform graded RTP processes.

Moving beyond multi-disciplinary methods to an inter-disciplinary approach (Fiore et al., 2008), requires a blending or combination of skills to provide service. Indeed, in healthcare the benefits of MDT and IDT working on better patient outcomes (Scott, 2021), patient mortality (Taberna et al., 2020), and innovation (Mitchell et al., 2017) are well researched across different facets of medical provision. Yet there is confusion in the terminology associated with these teams which has also led to confusion in this field of research (Martin et al., 2022). In sport, if we were to adopt an inter-disciplinary team approach, problem solving would need to be a shared endeavour. Practitioners would likely develop an understanding of other services and the ability to align with other them through applied practice. This is of benefit either to inform their own offering or to integrate insight and expertise that helps solve complex performance problems. The complexities of human performance in sport requires teams of cognitively diverse problem solvers to continue to innovate, evolve new techniques and approaches that push the boundaries of what is possible to create competitive edge (Vaughan et al., 2019). Much can be learned from clinical healthcare teams where there are some parallels with elite sporting contexts. Research has found that coordinated team based approaches between medical and psycho-social aspects of patient care can prevent delays, streamline communication and enhance quality of care (Taberna et al., 2020). Mitchell (2012) outlines fundamental principles of effective team-based healthcare emphasising shared goals, mutual trust, clear roles and effective communication as key elements of successful team work, findings somewhat supported by (Stewart et al., 2024a) who explored performance support team effectiveness in elite sport.

Statement 4: Practitioners who work in MDTs effectively share expertise, collaborate, and work together to deliver effective solutions.

Any individual's expertise is only accessible if the members of the team are open to sharing (Wilson et al., 2024a). Common language, shared mental models, shared ways of working and collaboration (Burns & Collins, 2023; Stewart et al., 2024a) can only emerge if communication is effective (Alfano & Collins, 2023; Hall & Weaver, 2001; Ulrich & Breitbach, 2022). Ego, power dynamics,, vulnerability (Hägglund et al., 2024) and imposter syndrome can cause conflict within teams that can supress open communications and engagement (Burns & Collins, 2023; De Dreu & Weingart, 2003; Salcinovic et al., 2022). The antidote to the dysfunctions of fractured teams, groupthink and echo chambers is perhaps constructive conflict, psychological safety, the building of trust, and healthy debate in a contextually nuanced way (Taylor et al., 2022). Psychological safety, has been recently popularised by Edmondson (2012). Psychologically safe environments are ones where individuals can speak openly and honestly sharing views and opinions without fear of recrimination. In safe environments, individuals are more likely to own up and acknowledge their mistakes enabling learning cultures in which individuals, teams and organizations can develop and flourish (Edmondson et al., 2004). In sport, where jobs can be tenuous and can change depending on investment, popularity of the practitioner, power gradients, and who within the team are considered to have the "boss's ear," may all serve to supress collaboration and psychological safety.

Practitioners also require purpose to collaborate. If team members' work is delivered in silo, process orientated, and through checklists and protocols as per their professional training, it may be harder to foster collaborative ways of working and problem-solving approaches. Certainly, in clinical professions, practitioners are bound by medical confidentiality, a constraint not typically imposed on performance practitioners. This limitation restricts their ability to fully disclose pertinent and essential information. Effective leadership and role clarity, themes identified through both Burns and Collins (2023) and Stewart et al. (2024a) are critical to effective MDT working (Walinga, 2017). Leaders often empower practitioners, facilitate effective communication and set the tone for collaboration across the MDT. The leader creates the environment that the team operates within (Bartlett & Drust, 2021; Salcinovic et al., 2022), the expectations on how the team will behave, they provide MDT role clarity and purpose (DeWeese et al., 2023) and they are often the one who identifies the projects and plans of the team through which they integrate their expertise.

The way in which the MDTs is organized within the organizational structure can also have a bearing on the effectiveness of collaboration and sharing of expertise (Fiore et al., 2017). Where a team is "vertically integrated" for example, a Head of Discipline overseeing and managing a professional department (such as the Physiotherapy or Biomechanics department) this can amplify issues of practitioners staying in their lanes (i.e. within their department or specialism) and not being accessible to the other departments. Alongside this, due to different and conflicting perspectives across the disciplines (between the heads of and practitioners), departments become fixed in their views and positions, constantly attempt to undermine their colleagues, and seek to win points at the cost of creating better solutions.

Multi-factorial Approach to Effective Work by the MDT

The assumptions and their associated rationales supported by the literature provide insight into the collaborative dynamics among MDT practitioners in the delivery of their work. It becomes apparent that alignment of various factors is vital to the successful performance of MDTs.

These factors include the training modalities (King et al., 2024a), the promotion of knowledge integration among practitioners (Bartlett & Drust, 2021; Rothwell et al., 2020), their problem-solving methodologies and decision-making approaches (King et al., 2024a), the team environment and climate in which they operate (Salcinovic et al., 2022), as well as the organizational structure and departmental arrangements (Wagstaff & Quartiroli, 2023). Additionally, the pivotal role of leadership in delineating roles and ensuring team coherence significantly influences the team's ability to collaborate effectively (DeWeese et al., 2023).

The purpose of the current study is to explore how MDT practitioners approach their work in high performance sport with a specific focus on collaboration and problem-solving. The goal is to gain insight and sense of clarity of how and what practitioners need to be effective in their role by investigating practitioners' views, beliefs and perceptions. Through this study we hope to confirm or challenge the assumptions posited above and as a result suggest a thematic framework and identify core themes that could assist practitioners, leaders, and organizations to maximize the effect of MDT work in high performance and elite sport.

4.2.3 Methodology

Philosophical Approach

Reflexive thematic analysis (RTA) (Braun & Clarke, 2019) is a flexible qualitative approach that provides a series of choices and offers diversity in the way RTA is utilized (Braun & Clarke, 2023). The diversity of RTA allows for a distinction between what (Kidder & Fine, 1987) refer to as "small q" (post-positivist) or "big q" (non-positivist, reflexive) qualitative approaches, allowing the methodology to be aligned with researcher philosophies (Finlay, 2021). There has been confusion over the use of RTA as a method rather than a methodology (Braun & Clarke, 2019) with the authors suggesting that researchers should state their ontological and epistemological perspectives as part of the methodology (Braun & Clarke, 2021a, 2023).

The approach used in the present paper aligns more closely with "big q" research which acknowledges the researcher's active role in the production of situated knowledge with an inductive, data-driven approach. We view researcher subjectivity as a valuable addition which should be embraced rather than a seen as a threat (Braun & Clarke, 2023). Through a relativist ontological lens (Braun & Clarke, 2021a), people's views, beliefs and experiences shape their perspectives which are their individual and therefore perceptual truths. In adopting this constructionist philosophical stance (Braun & Clarke, 2021a), an interpretivist epistemological (Braun & Clarke, 2019) approach to answering the research question was a qualitative research design. This approach facilitated deductive exploration of the views, perspectives, and experiences of MDT practitioners working in high performance sport through focus groups where experts shared opinions, experiences, and beliefs through storytelling and sense making, through which, individual and socially constructed meaning could emerge.

Due to the lack of published research in this area a methodology was constructed that was inductive enabling the extraction of meaning from a sample of contextually immersed high-performance practitioners. Our intention is to generate practically derived insights that will drive a broader research agenda in this space.

Ethical Considerations

Ethical clearance was approved by the host university panel (BAHSS2 0385, see Appendix B). Practitioners were recruited through (1) the researcher's network, (2) emails to high-performance sporting organizations that employ MDT practitioners, and (3) social media campaigns. All respondents read a participation information sheet and provided informed consent prior to taking part. In the briefing at the start of each focus group, practitioners were reminded of ethical considerations and obligations including their right to withdraw, anonymity, and confidentiality.

Protocol

The focus group instrument consisted of six open questions (Table 4). Questions were shaped to illicit interpretation by the individual and kept brief and open to avoid supposition that would have constrained responses and funnelled discussions toward contextual or operational "doing" rather than how the individuals think about certain things (Roberts, 2020). Although there was structure and a design to the focus groups, the flexibility of RTA enabled each focus group to share, explore, and meander through the questions while the researcher could react reflexively to the conversations probing further when required or something was of interest.

Table 4: Questions used in the focus groups to stimulate discussion

Number	Question
1	Would you describe working as part of a MDT a help or a hindrance to your effectiveness?
2	Is collaboration important when working as part of an MDT? Why?
3	Is 'sharing' an important requirement of your work?
4	Is Decision Making an important requirement of practitioners working in MDTs?
5	Problem Solving is a term often used in high performance sport. Do you have to solve problems?
6	What are the skills and expertise that is required to be effective within an MDT? Where do you feel that you learned these skills?

Participants

Twenty-eight MDT practitioners (male $n = 20$; female $n = 8$) from various high performance sporting organizations were selected. With a diverse range of expertise and experience, they provided rich discussion across 5 different focus groups (Table 5). Inclusion criteria required

participants to be working in or have previous experience working as part of an MDT in elite or high-performance sport. Working in elite or high-performance sport was defined (Swann et al., 2015) as "a practitioner providing services as part of an MDT in a paid "part" or "full" time capacity within a professional institute or sporting organization supporting funded athletes who compete on world class programs, professional sport, or are on a funded development pathway." Eighteen ($n = 18$) individuals were not selected for participation because they did not meet the criteria.

Table 5: *Participants by focus group*

CODE	Gender	Focus Group	Sector	Discipline	Sport
P1	F	1	Elite Development Pathways	Physiotherapist	Hockey
P2	M	1	World Class Development	S&C Coach	Home Country Sports Institute
P3	M	1	World Class Development	S&C Coach	Home Country Sports Institute
P4	M	1	World Class Programs	Physiotherapist	Home Country Sports Institute
P5	F	1	World Class Development	Physiotherapist	Home Country Sports Institute
P6	M	1	World Class Programs	S&C Coach	Home Country Sports Institute
P7	F	1	Professional Team Sports	Physiotherapist	Cricket
P8	F	2	World Class Programs	Doctor	Home Country Sports Institute
P9	M	2	World Class Development	Physiotherapist	Home Country Sports Institute
P10	M	2	Professional Team Sports	S&C Coach	Cricket
P11	M	2	Professional Team Sports	Sports Scientist	Football
P12	M	2	Professional Team Sports	Athletic Trainer/Head of Performance	Football
P13	F	3	World Class Development; Professional Team Sports	S&C Coach; Sports Science	Squash; Football
P14	M	3	World Class Programs	Head of Performance	Snowsports
P15	M	3	World Class Programs	Head of Physical Performance	Home Country Sports Institute
P16	M	3	Professional Team Sports	Head of Performance	Cycling
P17	M	3	World Class Programs	S&C Coach	Home Country Sports Institute
P18	M	3	Professional Team Sports	S&C Coach	Baseball
P19	F	4	Professional Team Sports	Psychology	Football
P20	M	4	Professional Team Sports	Sports Science	Football
P21	M	4	World Class Development	S&C Coach	Home Country Sports Institute
P22	F	4	World Class Programs	Head of Performance	Hockey
P23	M	4	Professional Team Sports	Head of Academy Sports Science	Football
P24	M	5	World Class Programs	S&C Coach	HCSI
P25	M	5	World Class Programs	S&C Coach	Rugby
P26	M	5	World Class Development	S&C Coach	HCSI
P27	F	5	Professional Team Sports	Physiotherapist	Adventure Sports
P28	M	5	World Class Programs	S&C Coach	Rugby; International Country Sports Institute

Note. Twenty-eight practitioners took part in five (*n* = 5) focus groups. Practitioners were from a variety of sectors/backgrounds: World Class Development (*n* = 7); World Class Programs (*n* = 10); Professional Team Sports (*n* = 10); Elite Development Pathways (*n* = 1). Sports represented by participants included Home Country Sports Institute (*n* = 12); football (*n* = 6); cricket (*n* = 2); hockey (*n* = 2); rugby (*n* = 2); and snow sports, adventure sports, cycling, and baseball (*n* = 1, each).

Data Collection

The RTA was conducted following a six-staged process (Braun & Clarke, 2006). Each focus group was conducted through Microsoft Teams® where it was video recorded, transcribed, encrypted and stored electronically and securely on the university network before being analyzed.

Data Analysis

Each of the recordings and transcriptions were reviewed to become intimately familiar with the data. The data were coded, and the coding refined as the researcher analyzed and reanalyzed the transcripts creating several sub themes across each of the six questions (Table 4). This process was repeated for all focus groups and a summary of the findings was produced for each. Once all focus groups were completed, the researcher considered all the sub themes within each question and further collapsed them to create key sub themes aligned to each question.

4.2.4 Results

Questions and domain topics were identified by the researcher (RK) and further collapsed to create four clear domain themes that encapsulate the "what"; these were (1) Decision Making & Problem Solving; (2) Collaboration & Knowledge Sharing; (3) Interpersonal Skills & Development and (4), Leadership & Team Dynamics. Each domain topic was created through the questions presented in Table 4 and then defined through the domain themes identified in the analysis. The domain themes were further analyzed to create four overlapping themes (the "how") that appeared to permeate across the domains and lubricated effective MDT working (see Table 6 and Figure's 7, 8, 9, 10 & 11).

Table 6: The 'lubricants' of effective MDT working

	Theme
1	**Cognitive diversity is important but not if it slows us down:** *Diversity of skills, perspectives & ways of thinking*
2	**Staying in your lane is encouraged however sharing and collaboration is important:** *Role clarity and shared understanding*
3	**We need psychological safety however poor behaviour keeps getting in the way:** *Psychological safety and positive team dynamics*
4	**High confidence in a world of nuance and uncertainty; adaptability and context is key.** *Adaptability and contextual awareness*

Narrative by themes

Theme 1: Cognitive diversity is important but not if it slows us down
Diversity of Skills, Perspectives and Ways of Thinking
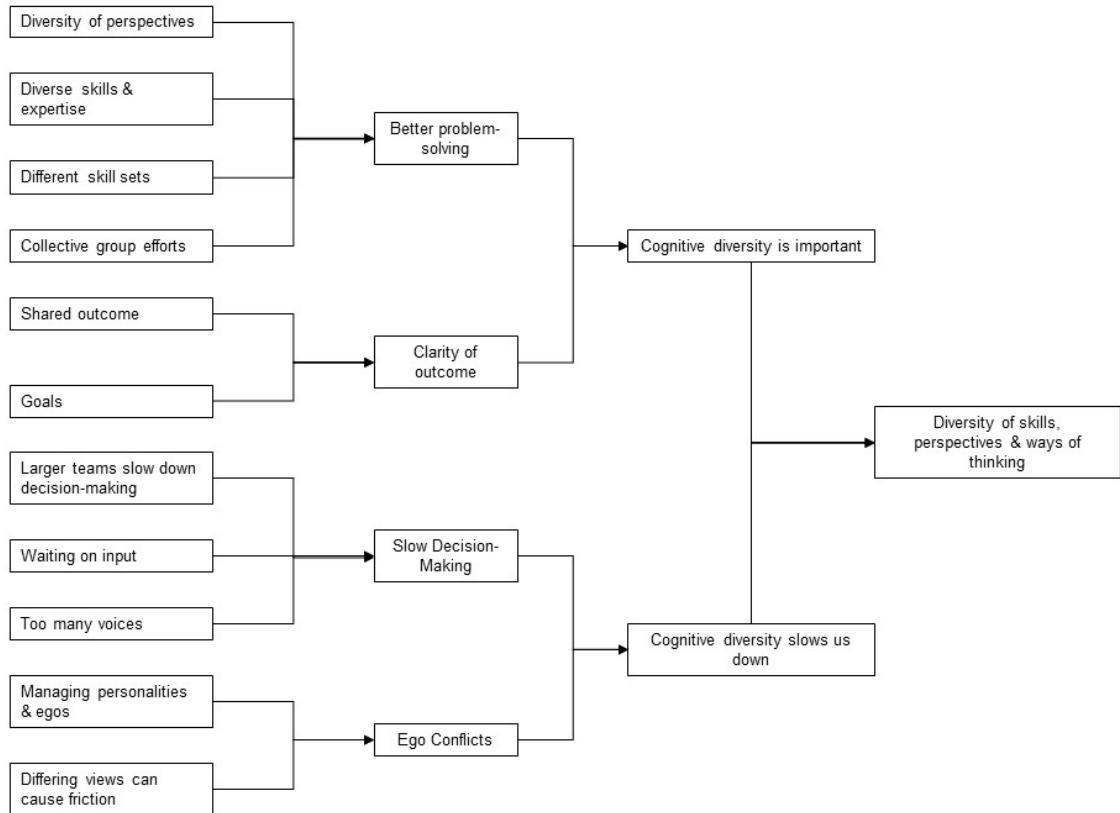
Figure 7: Perceived benefits and challenges of MDT working in elite sport[8]

Why diversity is important

Practitioners in each focus group references the importance of diversity in MDTs. It appears that diversity creates better decisions, solutions and outcomes. This is acknowledged by practitioner [P11; FG3] who states "*I don't think anyone would disagree that collaboration is important… ultimately working together, a group of people with different skill sets and expertise coming together to create an outcome*". Alongside the skills and expertise creating better outcomes practitioner [P28; FC 5] states:

> "*Solving any performance problem strength in numbers is key and having a collective group of minds pulling in the same direction really does make the problem simpler and I guess it's just a reflection of diversity. The more diversity you have in an environment, the potentially the better the number of perspectives that you're going to see a problem from that help you solve it a little bit better*".

Utilising different perspectives in an attempt to solve problems, practitioner [P6; FG 1] highlights that different skills are required suggesting, "*To solve the problem you require different skill sets and I think the benefit of having multiple practitioners, it just allows different skills to contribute towards a solution, which I think is important*".

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[8] Figures 7, 8, 9 & 10 and are thematic maps that were created through the analysis and subsequent coding of the data that was collected as part study 2. These maps were not presented in the accepted publication (King et al 2024) but were the basis of Figure 11 that is presented in the manuscript (Figure 11).

What is diversity and when is it useful

Practitioners recognise the importance of working in a team of individuals from diverse backgrounds. In several of the focus groups practitioners described what a diverse MDT looks like and when it is useful. An example here from Practitioner [P1; FG 1] outlines what diversity is in an MDT and when it is useful:

> *"It depends on the context. It depends on the personalities, and I think an MDT is really important in the fact that you got people with different experiences, different both in terms of areas they've worked in, in terms of length of time they've worked in an area and different skill sets… You've got different people with different personality skills and all of that can add to having a much more thorough discussion, but equally you get more chance of different egos and attitudes towards things. So it could be that again, someone else's experience might be completely different to yours, and therefore their view is completely different to yours. So, it very much depends on the context and the relationships that you've got within the MDT".*

Alongside context playing a part in accessing diversity, practitioner [P18; FG 3] also observes:

> *"The more you have key stakeholders providing an input and providing different perspectives from different lenses on how to develop a programme or a player is always helpful. But it tends to come back to a couple things in terms of clarity of outcome and also understanding your constraints and then the flexibility within the team".*

When diversity gets in the way

Despite the strong inclination from practitioners to work as part of diverse MDTs, there appears to be a cost benefit trade-off that was highlighted across the groups. Practitioner [P21; FG 4] states:

> *"I know some people might say you can move faster as a smaller team or individually, but you can move further as a bigger team. So I do think there's certainly value in this diversity of perspective sometimes not even just in terms of the different disciplines, but also just the different personalities and preferences that people bring to the team. And I think another unrelated thing would be just it depends on the individuals in terms of how well they work together. I think the people in the team, their experiences, their values, they're ability to work with people essentially and sort of manage their own egos as well".*

Alongside the concept of faster-further, practitioners also noted that MDT working has the potential to slow down progress, practitioner [P3; FG 1] remarked "*the negative for me is you know sometimes the boat can go a bit slow because everybody's having a chat about who's going to be doing what when. So it ends up being a bit slow*". An observation supported by practitioner [P12; FG 2] who said "*Oftentimes you are just waiting on somebody or another department to respond to emails or produce a document or get some answers to be able to move forward so at times I think it slows down the process a bit*". As well as being slow, a greater number of voices can also present a challenge. Practitioner [P14; FG 3] suggest:

"*You have to make the decision at the end of the day. It's really easy when you're working the team for everyone have their voices and be going around the circle for days and days, but ultimately you gotta do some kind of action*".

Theme 2: Staying in your lane is encouraged however sharing and collaboration is important

Role Clarity and Shared Understanding
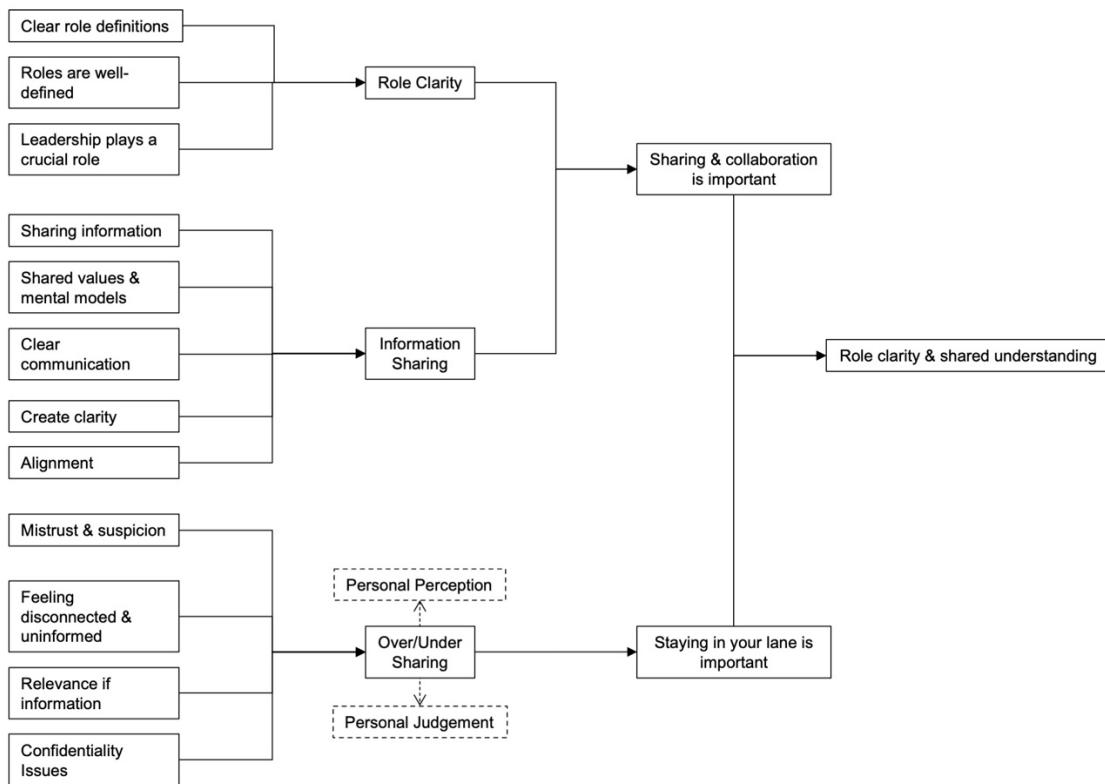
Figure 8: Perceived importance of sharing and collaboration by MDT practitioners in elite sport: Role Clarity and Shared Understanding

Sharing information

Practitioners default consideration when discussing collaboration and sharing tended towards the information they personally held or that they required to do their job. Across the focus groups, the conversations consistently orientated towards information as a source of collaborative MDT working. As practitioner [P26; FC 5] stated, *"If we're sharing information, it should be with the intention of creating further clarity". Practitioner [P17; FG 3] observed "what are the areas that the key stakeholders need to be genuinely working together to create collaborative change that's gonna create an actual desired outcome"*.

This consideration is supported by practitioner [P19; FG 4] who offered, "*So sharing is important. If it's in the best interest of that athlete at that time and it's the best way we can get them on a good path but sometimes I think we're guilty of maybe oversharing that information*". Practitioners raised both over and under sharing as considerations. For example, practitioner

[P21; FG 4] said *"I'd be guilty probably of under sharing in terms of like it might not be relevant to that practitioner, but I think sharing was important not just to inform their decision making but actually just to keep them connected to the team's purpose and the outcomes"*.   This suggests the use of personal judgement and a personal perception of what is or is not relevant at the individual discipline level.

Concerns were discussed across the focus groups and questions raised over what should and could be shared with the rest of the team.   It seems practitioner's judgement over whether information was important enough to share or indeed could be shared due to confidentiality practices is an important consideration.   Practitioner [P22; FG 4] pointed out *"It's hard to navigate... we need some of that information so that we can help performance from our approach to the athlete"*.   They go on *"I just find that such a fascinating piece of the MDT because it is a requirement but there's that confidentiality piece as well, [having referenced mental health] same with doctors, same with medical as well, it's navigating how we can do that"*.   [P9; FG 2] highlighted the challenge and cost of this stating *"What I've seen is really toxic in a team is a culture where there's a sense of stuff's not shared and it almost immediately breeds division and it immediately breeds suspicion and fragments your team straight away"*.

Sharing to create alignment

The exchange and sharing of information should be determined by the MDT's purpose, project or goal.   Practitioner [P22; FG 4] states, *"What is the direction you're trying to go or the project that you're working on. It can't just be done in silos and think you're going in the same direction"*.   Practitioner [P25; FG 5] states:

> *"Sharing is an important requirement of work if it is of not a distraction to what we're trying to achieve, it has to obviously align. Even if I believe something aligns to the purpose or the direction we're going in, I've got to be really careful about sharing anything that is not mine and context obviously drives that"*.

Several practitioners acknowledge the importance of sharing on a deeper level to drive effective MDT outcomes.   Practitioner [P11; FG 2] observes, *"in terms of shared values, shared mental model, shared intelligence, etcetera, I think that's important that those are the guiding light of everyone knows where we wanna go, what the strategy is"*.   This is very similar to the comment made by practitioner [P26; FG 5] *"I think for me a shared mental model, shared worldview is probably key for effective collaboration to happen. I think we all need to be communicating from the same place and understanding each other and clear on what we're going after and why"*.   Another consideration raised by practitioner [P12; FG 2]:

> *"I think there's sharing a common way of working, we all share that we all understand how we're working and what we're working towards, but also sharing your experience and sharing your expertise and sharing your thoughts on the process and the system and perhaps the values whether they're aligned or not"*.

Role clarity and understanding your contribution

Alongside the practitioner's personal judgement about what they should share, there is a need for practitioners to understand their and other's role and can judge when collaboration and

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sharing is required.   As practitioner [P22; FG 4] suggests *"The issues or problems that we've had to solve is because there's been a lack of understanding of what the roles and responsibilities and who does what and understanding how we all fit"*.   When there is this clarity practitioner [P2; FG 1] observes:

> *"I think it's intelligent that if there's an S&C coach and they're really good at the core bit of their role and they know that the physio is really good at the core bit of their role then we might have these little interactions and discussions to help things kind of run smoother".*

This thought is reinforced by practitioner [P11; FG 3] who acknowledges *"It's not to say that you shouldn't look to work together, there needs to be a clear idea of where that's actually going to be helpful, where's the areas that just getting out of each other's way is actually very impactful".*   A point reinforced by practitioner [P16; FG 3]:

> *"I think the point is that definition of collaboration is important. It doesn't necessarily have to mean you're working together with others, you just may see the signals to recognise that you need to step away and create space for that individual to be effective".*

Sharing and the role of leadership

Practitioner [P20; FG 4] identifies the critical role that leadership plays in creating role clarity whilst also bringing into vision this concept of staying in your lane, they state *"Clarity from leadership is critical to impacting that effectiveness because if you have role clarity it's easier for everyone to stay in their bounds and be more effective within those bounds"*.   Leadership appears to be critical to both creating role clarity and setting the tone by which sharing occurs as observed by practitioner [P28; FG 5]:

> *"If you're practitioner working in the environment and someone says stay in your lane, that's pretty triggering aggressive and most people see that as unacceptable and insulting. I think there's a leadership component, I would say I've experienced both sides, being very clear on what I was expected to do and how I was going to be judged but at the same time, being told, mate, this is not your field push on".*

Organisational structure was also raised as a consideration in facilitating effective collaboration and sharing with practitioner [P24; FG 5] observing *"in the golden world you know more shared decisions, better shared knowledge, and then it's a better opportunity for a better outcome"*. They go on to suggest, *"It's the group dynamics, do you have the right people in the group and does everyone understand their roles of what they've got to share... I think that it all comes back down to the group dynamics and whether you are horizontally or vertically integrating".*

Theme 3: We need psychological safety; however poor behaviour keeps getting in the way

Psychological Safety and positive Team Dynamics
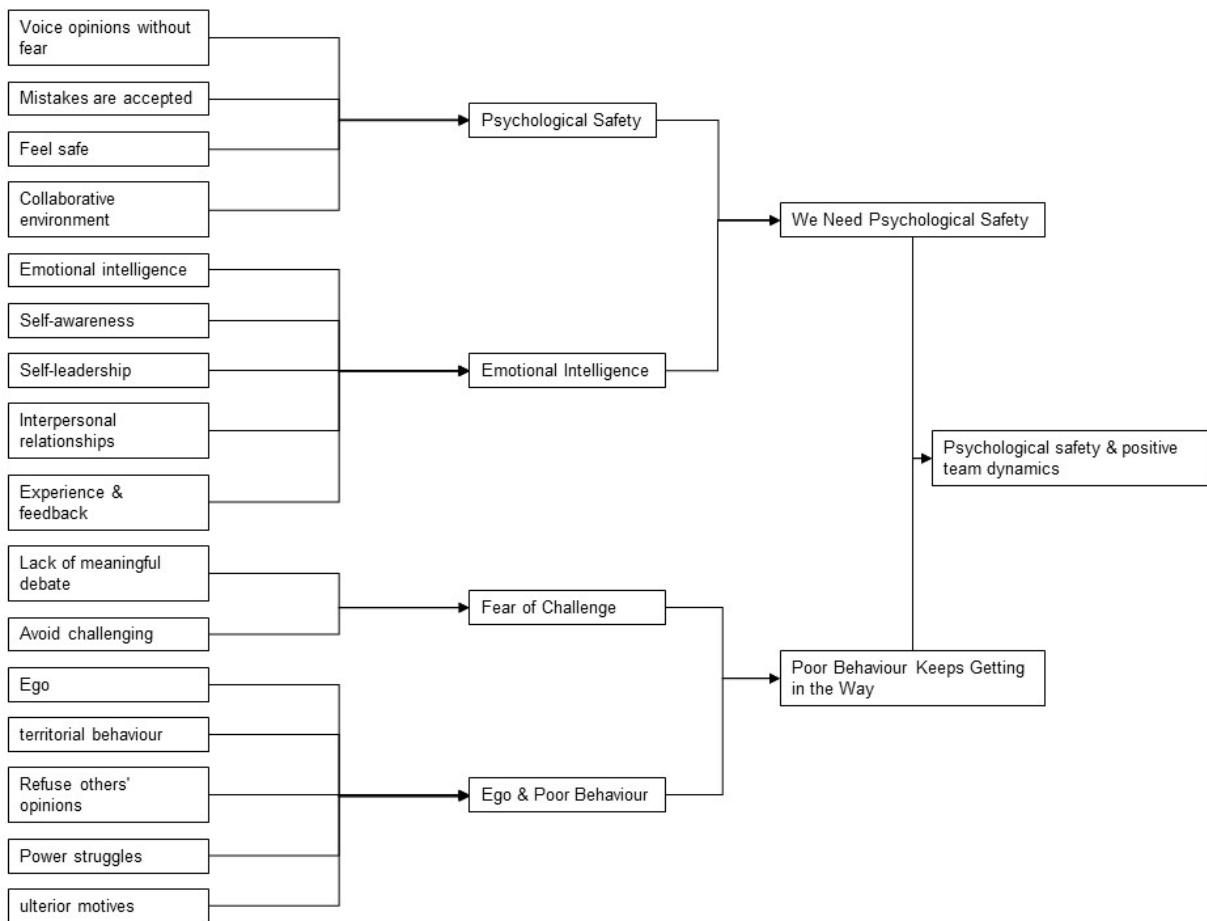
Figure 9: Perceived importance of psychological safety and positive team dynamics by MDT practitioners in elite sport

Characters and ego

Through the first two themes, we have illustrated the importance of both diversity, collaboration and sharing in creating optimal solutions and outcomes. Practitioners that work in MDTs therefore have to be able to work with others effectively in a psychologically safe environment. Practitioner [P10; FG 2] states:

> "it's just down to the characters of the personnel that you're working with, whether they want to or feel comfortable collaborating or whether they prefer to work in in silos. I've had those experiences where I have felt it [the MDT] has become a hindrance, but that's not because of the MDT itself, that's just the characters within it".

Alongside the characters within the MDT, consideration should be given to the environment "*the character traits need to fit the MDT or the MDT needs to create that safe psychological space for people to operate in an effective manner*" [P25; FG 5]. Practitioner [P16; FG 3] recognises that expert practitioners have to be able to operate with others "*I guess it's that*

sometimes, although you have a particular level of expertise, so you're the inch wide mile deep, you know in true integrated approaches, you often gotta operate horizontally as well". Multiple practitioners report experiencing poor behaviour that acts as a blocker to effective MDT working including between professional domains, practitioner [P8; FG 2] shares their experience:

> *"I've had similar experiences and my take on it is sometimes it's egos, people saying this is my domain, how dare you step into it. In our world [in sports] the boundaries overlap and working in a really high functioning MDT is where everyone is comfortable that the boundaries overlap and you work together and that its absolutely fine to be checked and challenged".*

Practitioners frequently reference ego as getting in the way of effective team working, Practitioner [P13; FG 3] highlights their frustration stating, "*I've also been unlucky enough to work with people who aren't willing to listen to other people's opinions and potentially let their ego get in the way of decision making*". Practitioner [P9; FC 2] acknowledges that ego needs managed stating:

> *"I think the power of the MDT comes when [P8; FC2], I think you mentioned ego and when you take that out of it and nobody's too rooted on success being down to their contribution… but the leadership and the management of the egos and the group is the key part in how you get to that point".*

It seems that difference of views and opinions can be seen as challenging and this might be related to ego or difference of opinion and/or bias. Practitioner [P5; FG 1] observes, "*When you come against people who are so entrenched in their own beliefs and the barriers are so high that they're almost scared to allow it just to come down slightly too even begin to contemplate something else*". They go on, "*…the more that you tell somebody that's not quite right, the more that they're going to come back at you with the reason why it is correct*".

Team dynamics

Practitioners recognise the limiting nature of poor team dynamics on MDT working, "*it can lead to some very negative outcomes and lead to a very negative atmosphere within the team, it's more likely a very negative foundation for going forward*" [P15; FG 3]. Practitioner [P28; FG 5] states that poor team dynamics such as "*Ego, power struggle, ulterior motives, all those components which are not helpful because we've actually lost track of the fact that we're trying to address a performance problem or an issue with a player, whatever it might be*". A point echoed by practitioner [P27; FG 5] who states:

> *"If there's ego, power dynamics involved. If it's collaboration with the intention for self as opposed to the intention of moving towards an aligned and shared goal. Then I would argue that's not genuine collaboration and then it's someone using a group for their own purposes as opposed to collaboration for collaboration sake.*

In contrast to the issue of self-serving interest, there is also a fear or aversion to challenge as observed by practitioner [P6; FC 1]:

"*You go to an MDT meeting but then what ends up happening is a lot of people just end up agreeing with one another… I find less often than not, do we have a meaningful MDT meeting where people are able to actually really put contrasting views on the table*".

They go on:

"*You discuss, debate, check and challenge and I think the key bit is when you go to a place where you're actually uncomfortable, but then you're able to go and have a beer afterwards. I think that's the sort of position where real collaboration occurs and that requires a degree of skills to be able to do that*".

The ability of the team to operate horizontally, integrate their expertise and debate and disagree well stems from practitioners ability and skill to operate with one another and consideration should be given to how this is agreed. Practitioner [P17; FG 3] summarises:

"*The shared knowledge and understanding of how to operate in a non-technical way with each other... What are the identified communication strategies? How are we effectively listening to each other to be able to support and understand? What kind of questioning approach can we take to be able to support each other, to share the information that we need? And how can we kind of interrogate each other in a comfortable way?*

Psychologically safe environments and making mistakes

For practitioners to contribute without fear of being wrong, making mistakes or being found out, environments must feel psychologically safe and this, practitioners suggest requires a level of psychological safety:

"*And I suppose you need to have emotional intelligence. And I think that's kind of what people have touched on in terms of having an environment of psychological safety so that people do actually feel they can voice their opinions and knowing when to speak up and when not to*" [P27; FG 5].

There appears to be an individual and an environmental aspect to psychological safety which practitioner [P7; FG 1] encapsulates "*Although people don't want to admit that they're wrong, that things have gone wrong… When it's a good environment that it feels like you can make mistakes, I think that's a really crucial time to really grow as a practitioner*". The ability to acknowledge mistakes also suggests psychological safety is required as observed by practitioner [P22; FG 4], "*I think there's a bit of a culture... being able to be humble and vulnerable, where are our weak spots within our practise and if you can have that in a psychological safe environment to have those humble conversations*".

Emotional intelligence was referenced as a key requirement of MDT practitioners. "*When you talk about skills and expertise, we can think about self-awareness, self-leadership, self-regulation. Self-regulation only works with those around you so your co-regulation's really important*" [P16; FG 3]. Practitioner [P21; FG 4] acknowledges, "*I guess it comes into that*

emotional intelligence doesn't it in terms of not just being able to manage yourself but also recognise that in others". The importance of emotional intelligence appears to be acquired experientially "*I learned these often through experience, quite brutal feedback sessions if I'm really honest, making quite poor decisions in my career at times which were catalysts for change*" [P16; FG 3]

Theme 4: High confidence in a world of nuance and uncertainty; adaptability and context is key

Adaptability and Contextually Aware
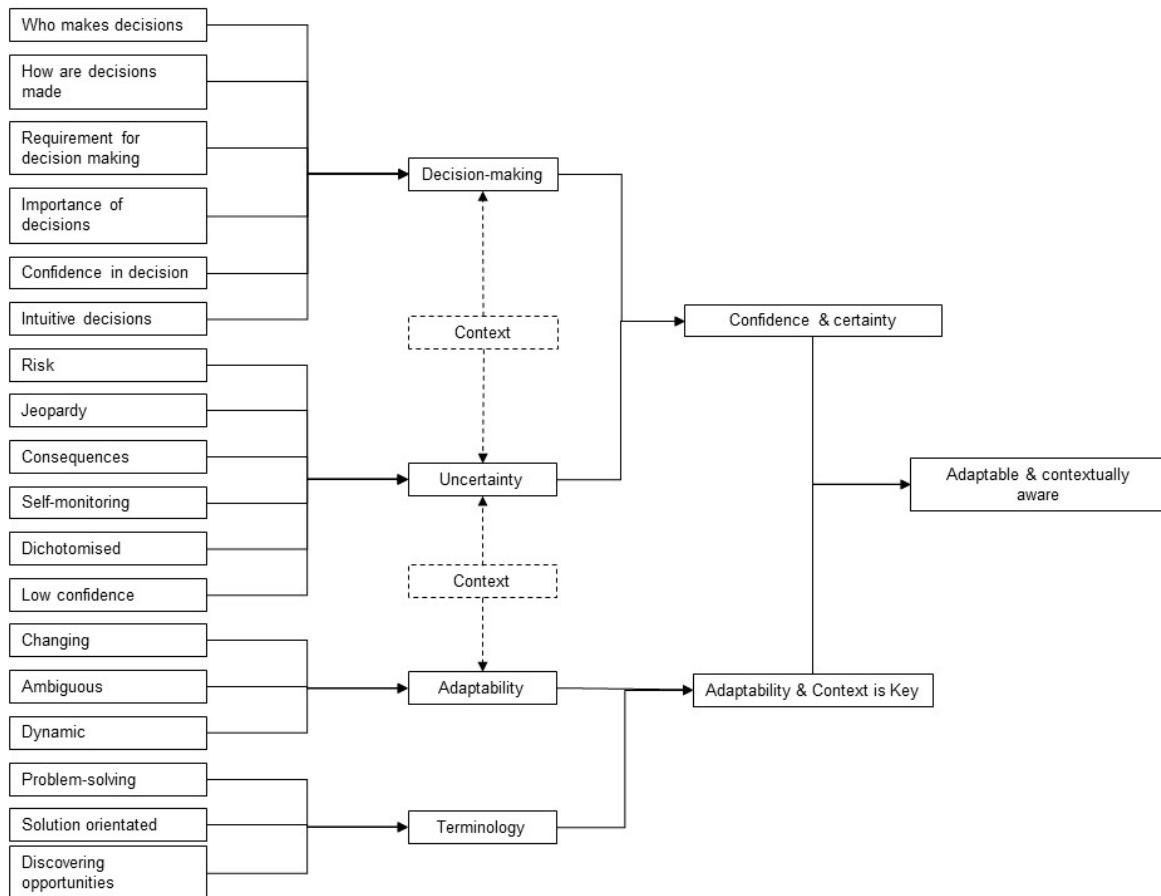
Figure 10: Perceived importance of adaptability and contextual awareness by MDT practitioners in elite sport

Decision-making

Whilst practitioners share information, collaborate and operate through an MDT, it appears practitioners have a range of views regarding 'what' they do. Despite frequently referencing the decisions they take as practitioners, it was clear that there was some ambiguity around awareness of both who and how decisions are made as a practitioner, [P17; FG 3] "*I don't know if decision making skills is a necessary part of the whole team or just a handful of individuals within the team*". A sentiment echoed by [P13; FG 3] "*There's certain practitioners in roles*

that are gonna have more decisions to make than other practitioners, but also practitioners who will have more important decisions to make as well or decisions that might have bigger implications on the outcome". Alternatively, some had a degree of confidence that decision-making was an important element of their role:

> "*It's probably one of the most fundamental parts of being a good practitioner, you've gotta be good technically, but it's your ability to make good and sound decisions based on the contextual information that you have but there's also different layers. There's decision making from a practical in the moment perspective. There's decision making from a wider team project perspective and there's decision making around sort of a general system or cultural change perspective... I think it's the thing that separates the ones that are very good at their jobs and the ones that maybe aren't as good is their ability to make good decisions consistently and regularly*" [P18; FG 3]

Regarding how decisions are made a number of practitioners reference intuitive decision-making, "*My sense is that a lot of decision making, even quite technical decision making is quite intuitive*" [P9, FG 2]. Another example was suggested by [P21; FG 4], "*So I think that's another part of this intuitive decision making is that you're making intuitive decisions all the time... you might see a pattern, but then you're like, OK, I'm going to make a decision*". Consideration should also be given to practitioners confidence in their decisions and how they resolve this, practitioner [P6; FG 1] states, "*If you've got a medium and definitely low degree of confidence, you certainly are gonna consult the people around you to help you make that decision*".

Coping with uncertainty

MDT practitioners must deal with uncertainty and risk. Practitioner [P5; FG 1] asks:

> "*What's the jeopardy here? Who is gonna actually be responsible for the decision or the decision making? Who's actually gonna get the finger wagged at them if it goes wrong? ...But it's also about cutting a deal. What's the end result? What is the decision we have to make here*"?

There seems to be some level of self-monitoring around the context in which decisions are made and their associated level of risk. Practitioner [P13; FG 3] states, "A *big element of uncertainty around decision making is deciding what level of risk you're happy with and also, just looking at the context and who's at the centre of having that impact of your decision*". Practitioners report uncertainty around how they make decisions as evidenced by the following passage from [P4; FG 1]:

> "*I think our world is very rarely made of clear cut dichotomised decisions which are right or wrong they're mostly grey and I think one of the biggest issues I see with practitioners is they stall the car at the T junction and because neither answer is correct, they stall... When there isn't a perfect answer, the expectation is, I'll just get some more data, more data will help me make the decision when actually it's just drive the car down the bloody road*".

Adaptability is key

Decision-making with levels of uncertainty and low confidence whilst solving ambiguous ever-changing problems emphasises the need for practitioners to be adaptable, [P16; FG 3] suggests, "*Our job as practitioners is to navigate that uncertainty as quickly as possible within your team*". [P1; FG 1] expresses a similar sentiment "*As a general theme, I work in an environment where there is a lot of uncertainty. So I think it's important. It depends on the level of risk*". Even when a decision has been made, [P3; FG 1] outlines his view on dynamic 'adaptable' decision-making:

> "*It's only the decision until it's not, and then we change and we do something else. It's just a changing decision rather than an end decision, it's still flexible. I remind myself that I can change decisions, change route, and go a different way*".

Decision-making or problem solving?

Practitioners frequently referenced problem solving across all of the focus groups and it would therefore be reasonable to assume that problem solving is a critical requirement of MDT practitioners. When practitioners were asked whether they solve problems a range of responses were given "*Is decision making the driver of problem solving? To solve a problem, you have to make a decision.*" [P11; FG 2] When differentiating between problem solving and decision-making [P12; FG 2] states:

> "*As [P10; FG 2] said, a problem implies that something is not fitting or there's something wrong or there is there's something that needs to be addressed in a way. You know, not all decision making is problem solving but is all problem solving decision making, I would say so*".

There also seems to be low confidence that problems are ever solved hinting at the nature of the problems faced by MDT practitioners:

> "*I'm not sure if I have ever solved one problem and it's come to a complete end. Normally I feel like I'm playing whack-a-mole most of the time, I might solve one thing and then there's two other things pop up and I'm like OK let's do that and then.*" [P14; FG 3]

A sentiment echoed by [P26; FG 5]:

> "*I think the overall problem is always performance at the end of the day whatever our sport is, so that's a problem that isn't going to be solved. There's no final endpoint of that problem, it's just one that we can hopefully add value to and move in the right direction*".

Terminology

Despite practitioner frequently using certain terminology, there was a sense that practitioners did not like the word problem solving. [P28; FG 5] observed, *"I don't think the language sits particularly well with other members of staff or support staff or certainly athletes in terms of talking about problems"*. Alongside this, [P17; FG 3] said "*I don't think it sits right with me that it feels that it's a chase to solve the problems, it's perhaps more of a frame of discover opportunities*". A similar view was expressed by [P22; FG 4], "*So I think that mind set of solution orientated is really important and I think it does also depend on the context of you know, solving problems or finding solutions*".

Practitioners frequently described their work as both decision-making and problem solving and yet many had a preference towards terminology associated with achieving outcomes and delivering solutions when directly asked about what they do.
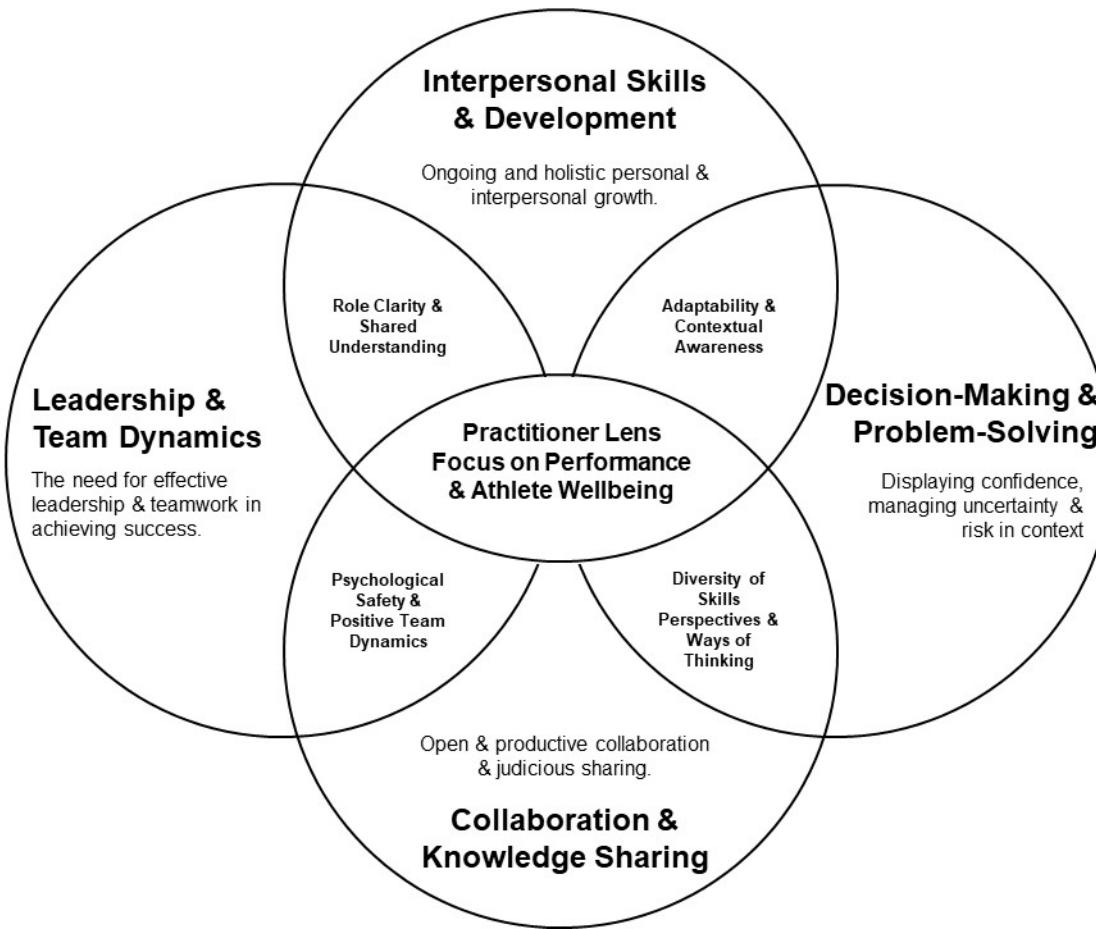
Figure 11: The Practitioners Lens: The 'what and how' of MDT working in high performance sport[9]

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[9] Presented in Appendix F is an infographic that was created to share the findings of study 2 on social media and also provides an example of the iterative process of theme/sub theme development and the evolution of its presentation.

Figure 11 depicts the inter-related MDT practitioner's lens on how and what they do to operate in high performance sport. Practitioners' focus is on athlete performance and well-being which is central to their work. To be successful there are four overlapping domains (the "what") that appear to be requirements of practitioner delivery. Finally, there are four lubricants (the "how") to successful MDT working that, when present, enable practitioners and teams to deliver (the "what") with impact.

4.2.5 Discussion

The current study aimed to explore practitioners' perceptions of how they operate as members of MDTs in high performance sport environments. By exploring their views, beliefs and perceptions as shaped through their experiences, four unique themes of how they operate were identified with implications for organizations, leaders and practitioners. These were (1), Cognitive diversity is important but not if it slows us down, (2) Staying in your lane is encouraged however sharing and collaboration is important (3), We need psychological safety, however poor behavior gets in the way, and (4), High confidence in a world of nuance and uncertainty; adaptability and context is key. Interpretation suggests there is overlap and inter-dependency between the themes across the domain topics (Figure 11). The domains appear to be critical requirements of an MDT, and the themes are lubricants to effective MDT working. The following discussion builds on these themes highlighting the potential challenges that face practitioners and the implications for practice.

Practitioners within this study recognised the need for cognitive diversity within the team acknowledging that it makes for better problem-solving capability, a view supported in the literature (Hong & Page, 2004; West & Dellana, 2009). Literature also suggests that diversity enriches team decision-making and fosters innovation, allowing the team to potentially achieve greater outcomes than smaller, less diverse teams (Aggarwal & Woolley, 2019; Horwitz & Horwitz, 2007). Practitioners noted that, discussions and deliberations within the team can sometimes lead to a slower decision-making process. Additionally, dependencies on external parties or departments can further impede progress, as waiting for responses or documents can prolong timelines, which in the fast-paced world of sport often mean that things have kept moving on before the MDT has had time to act. There is potential for confusion and misalignment within MDTs when team members revert to familiar patterns of mono-disciplinary working instead of engaging in collaborative problem-solving. For an MDT to effectively problem-solve, the team must move forward in an integrated manner, sharing expertise across disciplines. More research is needed to explore the different types of work and approaches that practitioners adopt, which would help clarify when and if integrated problem-solving is necessary and when diverse perspectives should be leveraged.

Furthermore, it was highlighted that the presence of numerous voices within the team can lead to difficulties in reaching consensus or making decisions efficiently (Mohammed & Ringseis, 2001). The need to accommodate multiple viewpoints may prolong discussions and hinder decisive action. When cross-functional teams face difficult problems, they can generate more and better solutions (Hong & Page, 2004; Page, 2019). It is clear there is ambiguity about whether practitioners are decision makers, problem solvers or skilled "procedural" doers (King et al., 2024a) with a range of views being suggested. If practitioners work in a process orientation to deliver clear outcomes or solutions then it is unlikely that diverse teams will add any additional value and could in fact slow down individual progress (Hong & Page, 2004;

Page, 2014), increase perceived bureaucracy and scuttle decision-making capability due to the number of voices and difference of views and opinions (Mohammed & Ringseis, 2001). The integration of departments and/or divisions to deliver MDT working models creates inter-dependencies which drives system complexity (Rijpma, 2019) and wicked/VUCA problems (Greenberg & Clubb, 2021; Sediri et al., 2020). This creates a conflict between the need for task focused (De Dreu & Weingart, 2003) versus problem-solving approaches, and between individual disciplinary expertise and a multi- or interdisciplinary approach. Consideration should be given to what is required by the team and more importantly, clarity on what they are expected to deliver.

Practitioners perceived "sharing" as information they either hold within their discipline or that they require from others to deliver the best possible outcomes. They used personal judgement on whether they should share information and tended to under share. It was clear that information wasn't shared at times due to information being privileged creating both a block to delivering performance solutions and providing a source of inter-personal conflict within teams. Information is a commodity (Otte et al., 2022; Rothwell et al., 2020) that practitioners can use to their benefit. The transactional nature of information sharing and the individual choice to share (or not) may drive some of the challenges (frustration/trust/poor decision-making) experienced by practitioner teams (Mesmer-Magnus & DeChurch, 2009). Further research is needed to investigate perceived power dynamics between practitioners across different domains (e.g., clinical and performance) and their influence on problem-solving capacity within MDTs. Understanding the distinction between true collaborative problem-solving, where the team actively integrates diverse expertise and cooperative information sharing driven by outcome or goal orientation is critical. These contrasting approaches have fundamentally different implications for how teams should structure their interactions and deliver solutions effectively.

The transactional nature of information sharing within the context of elite sport might breed power dynamics, hierarchical relationships and politicking across a team (Cowley et al., 2023; Mesmer-Magnus & DeChurch, 2009). It is apparent that organizational structure, team/discipline alignment (horizontally or vertically integrated) and the critical role of leadership are all factors contributing to effectiveness of sharing in and across MDTs (Axelsson & Axelsson, 2009; Burns & Collins, 2023). When we delved a little deeper into the concept of sharing it was clear that (re) positioning sharing as an ongoing exchange (between disciplines) i.e., skills, expertise, mental models, perspectives, values can create shared purpose, shared goals or a shared world view that can drive alignment between disciplines (Rothwell et al., 2020). Better outcomes for multidisciplinary teams (MDTs) in sports may result from role clarity, shared understanding, and a unified purpose or alignment of goals and objectives (Alfano & Collins, 2021), emphasising once more the significance of effective leadership (Burns & Collins, 2023; Walinga, 2017). Importantly, it transcends the perception of sharing "information" and reduces the risk of the commoditisation of information by disciplines. While unifying goals and shared objectives provide practitioners with a common purpose, they do not automatically foster true collaboration or collaborative problem-solving. Instead, teams often default to familiar patterns of cooperation and information exchange, which fall short of integrated problem-solving. To address this, greater focus is needed on how objectives and goals are crafted and framed to actively promote deep collaboration and problem-solving within MDTs.

From the current study findings, it appears that MDT practitioners in high performance sporting environments experience inter-personal challenges that act as a barrier to psychological safety

that might stifle collaboration. Ego, lack of desire to collaborate and inability to listen to others' views and opinions (Hägglund et al., 2024) were frequently referenced by practitioners. As well as challenging characters and poor behavior being present in teams, there is a perception that practitioners identify with, and are protective of their specific professional domains. Practitioners operating in their silo's and being reticent about collaborating and sharing will reduce the ability of the team to problem solve and align their practices around common purposes and outcomes (Edmondson & Bransby, 2023). Cross pollination of professional expertise with a respect for boundaries appears to be an aspiration. When people do not feel safe to contribute, they are less likely to participate (Mitchell et al., 2009). Participants in the current study recognise that negative atmospheres create toxic environments that stifle the productivity and effectiveness of the team. This further enhances the case for both leaders and organizations to consider how positive team dynamics are developed and psychologically safe cultures are fostered, this is no doubt a significant challenge for sporting organizations where results are the key measure of success.

Practitioners in this study expressed a desire and recognised the need for psychological safety. It is notable that this is aspirational as opposed to the reality of working in MDTs with several practitioners sharing their frustrations and challenges that team working creates. Underpinning this observation is the reflective (Knowles et al., 2023) nature of practitioners and their desire for interpersonal and professional growth. It seems that practitioners learn through their failures, mistakes and challenges and through this create a utopic view of what MDT working should look like. Also interesting is the observation that practitioner's feel they need to have emotional intelligence, be self-aware and can self-regulate to thrive in MDT contexts. This emphasises the importance of reflective (Knowles et al., 2023) and inter-personal skills. Notable is that in most cases these "non-technical" inter-personal skills appear to be learned through experience and/or life which supports the idea that mistakes, failure and challenge trigger reflective practices that help us to adjust, adapt and regulate our behavior (Huntley et al., 2023). Consequently, a greater emphasis should be placed on the development of skills that enhance the ability of cross-functional teams to effectively work together. Prioritising these skills and embedding them across educational, vocational and applied contexts (Cassidy & Rossi, 2006) would develop better practitioners and teams that are more effective (Alfano & Collins, 2023). Much could be learned from the health and social care sectors where inter-professional collaboration has garnered significant attention. The Inter-professional Education Collaborative (IPEC) in 2011 produced its first core competencies resource which has subsequently been updated in 2016 and again in 2023 (Interprofessional-Education-Collaborative, 2023). Inter-professional collaboration according to IPEC, consists of competencies of teams and teamwork, values and ethics, roles and responsibilities and communication. In sport, we assume that there is a need for collaboration and that practitioners possess the competencies or capabilities to practice that way without first considering the need. Figure 11 and the themes that created it suggest there are synergies between MDTs that operate in health and social care and high-performance sport. Our Figure can act as a bridge through which we could accelerate our learnings of how to maximise the benefits of MDT working and galvanise better support and research for inter-professional working.

Current study findings suggest that practitioners exhibit varying levels of awareness regarding decision-making processes within MDTs (Wilson et al., 2024a). While some emphasise the importance of decision-making skills, others express uncertainty about who makes decisions and how they are made. Intuitive decision-making (Kahneman & Klein, 2009; Klein, 2004; Salas, Rosen, et al., 2010) is referenced as a common approach, with practitioners relying on contextual information and seeking consultation when confidence is low. MDT practitioners

confront uncertainty and risk (Wilson et al., 2024a) in their decision-making processes. They consider factors such as the level of risk they are comfortable with and the potential impact of decisions on various stakeholders. There is recognition that decisions often involve navigating through ambiguity and making choices in uncertain circumstances (Wilson et al., 2024a). Given the inherent uncertainty and complexity of their work, practitioners stress the importance of adaptability. They emphasise the need to respond quickly to changing circumstances and remain flexible in their decision-making. Decisions are seen as dynamic (Hotaling et al., 2015) and subject to revision based on evolving situations. There is conflict here for practitioners as they must be adaptable to the current context, have confidence in their delivery strategies and provide decisive answers to questions that arise.

While practitioners frequently mention problem-solving as a critical aspect of their work, there is ambiguity regarding the relationship between problem-solving and decision-making. Some argue that decision-making is integral to problem-solving, while others express doubts about the possibility of ever fully resolving problems, likening it to a continuous process of addressing challenges. Despite using terms like "problem-solving" in their discourse, practitioners' express discomfort with the term. They prefer language that focuses on discovering opportunities and delivering solutions rather than framing their work solely as problem-solving. Whether practitioners work through a pre-prepared process to deliver predictable outcomes or unpack readymade solutions to recognisable problems, they will likely make intuitive "fast" decisions both as individuals and within a group (King et al., 2024a). Operating in these ways reduces the need for an integrated approach more likely relying on a silo-based orientation. Despite the aversion to the term problem solving, it was frequently used across the focus groups by practitioners. Depending on the nature of the problems, a clear delineated process is required to solve them in which the MDT should be involved (Schraw et al., 1995). This highlights the need for coordination and clarity from leadership and a separation between procedural "business as usual" delivery and innovating around novel difficult problems. This has previously been identified by King et al. (2024a) who proposed a framework for differentiating between problem types, problem-solving approaches and decision-making styles. This requires the leader, the team or the practitioner to make conscious, reasoned decisions about why and what they are doing and importantly how.

Limitations

Due to the novel nature of the study a focus group approach seemed appropriate. Further exploration of the themes identified with MDTs who work closely together may confirm or challenge the findings. Care was taken to keep the questions purposefully open in order to support individual interpretation; the conversations that transpired were broad. However, a more focused approach may have enabled the researcher to go even deeper and further in one or two of the elements that were explored thus giving greater breadth, depth, and focus to the analysis. Finally, practitioners volunteered and willingly participated, which may have attracted a specific type of practitioner. This could have inadvertently homogenized the group, potentially amplifying certain themes identified in the process. Focused studies of actual MDTs in the field—observing how they operate and what they think about, attend to and/or reflect upon—would offer novel insight into individual and team interaction and their processes.

4.2.6 Conclusion

Through the creation of a thematic map and the construction of four themes, data were used to illustrate "what" practitioners need to do as part of an MDT and how they should operate to work effectively in teams. Findings suggest that practitioners have more to contend with than just delivering technical skills. They operate in a world of uncertainty and risk, with challenging characters from different backgrounds in environments where mistakes are to be avoided and keeping quiet might feel safer. They tend to survive by using their information in transactions, trading it as a currency as and when required and based on personal judgement. Learning occurs through challenge, failure, and mistakes with practitioners ill-prepared for the realities of the situations and contexts they face. But through this reality, a utopian view emerges that we can aspire to in high-performance sport.

Our findings have implications for sporting organizations, leaders, and MDT practitioners. Creating psychological safety, developing positive team dynamics, and leveraging the cognitive diversity within MDTs will enhance problem solving. Training practitioners in how to deal with risk, uncertainty, and applied critical thinking, while providing them with clarity about roles and purpose, may better equip them with some of the skills they require to thrive. Finally, the "non-technical" individual and interpersonal skills that practitioners learn on the job might be better situated both in academic, vocational, and applied training contexts so that practitioners are set up for success instead of failure.

4.2.7 So what…?

- By exploring practitioners' experiences and views of working in MDTs in high performance sport, we have challenged some of the "taken as known" and "taken for granted" assumptions applied in this context and drawn out some important considerations for how MDTs operate in practice.

- Through this study we have been able to create a valuable model (Figure 11) for practitioners depicting what they should attend to and how they should operate in MDTs. Importantly, this model is developed for high performance practitioners through their own experiences of working in this context.

- Practitioners depict a reality of working in an MDT in high performance sport that is uncertain, challenging, and fraught with conflict. Through this dark reality, a utopic view of what and how MDT practitioners should focus on emerges through which we can develop training and support and drive a broader research agenda to support inter-professional collaboration.

4.3 Practical Implications

- MDTs in high performance sport require strong leadership and direction. There is a need for sporting organisations and leaders to create climates where MDTs feel

supportive and psychologically safe while ensuring clarity of purpose and alignment across their work (See summary infographic presented in Figure 12).

- Sharing information or withholding it can create conflict and harm team dynamics. The reframing of sharing as a continuous exchange of skills, expertise, perspectives, and values fosters shared goals and a unified purpose, ultimately strengthening collaboration.

- While decision-making and problem-solving are common terms in sports, MDT practitioners often lack clarity on the practical meaning of the terms, and they differ in their opinions of the relevance of the terms. Developing the ability to distinguish between these critical skills is crucial for practitioners and essential for effective MDT collaboration. Recognising and differentiating them will enable more purposeful use of individual strengths and foster more deliberate, collaborative problem-solving.

- Nuance, uncertainty, and risk appear to be a critical feature of an MDT practitioner's work in high performance sporting environments. Practitioners should be trained and equipped to deal with working in such contexts.

- Practitioners need to be better prepared for the realities of performing as part of a cross functional team understanding that inter-personal skills and adaptability may be a pre-requisite to success as a practitioner.

4.4 Summary Infographic (Study 2)

STUDY 2: Multi-Disciplinary Teams in High Performance Sport, The What and The How: A Utopic View or a Darker Reality

What are MDT's? Multi-Disciplinary Teams (MDTs) in high-performance sports combine various expertise to enhance performance and problem-solving.

Key Findings from the Study

28 Practitioners – 5 Focus Groups, analysed using a qualitative thematic approach

Decision Making & Problem Solving

Practitioners navigate complex decisions and solve problems collaboratively.

Interpersonal Skills & Development

Interpersonal skills are crucial for effective teamwork and personal growth.

Collaboration & Knowledge Sharing

Sharing knowledge and working together is essential for success.

Leadership & Team Dynamics

Effective leadership and positive team dynamics drive success.

How Practitioners Maximise Their Impact

Cognitive Diversity

Embrace diverse perspectives whilst maintaining efficiency

Role clarity & shared understanding

Define roles clearly whilst encouraging sharing

Psychological Safety

Create a safe environment for open communication

Adaptable & Contextually Aware

Be adaptable and contextually aware to handle uncertainty

Practical Applications for Sporting Organisations

Training & Development
Integrate non-technical skills into training programs.

Leadership & Team Dynamics
Promote clear roles, positive dynamics, and open communication.

Psychological Safety
Foster environments where team members feel safe to speak up.

Support for Dealing with Uncertainty
Equip practitioners with tools for managing risk and uncertainty.

Interdisciplinary Collaboration
Encourage collaboration across different disciplines for innovative solutions.

Practitioners create a **utopia** of what MDT should look like, most likely through failures, challenges and reflection suggesting a much **darker reality**. These practitioners continually refer to **leadership** as critical to successful MDT working.

What and how do leaders get the best out of MDTs in high performance sporting contexts?
_..Study 3

Figure 12: Summary Infographic of Study 2.

4.5 Link to Study 3

4.5.1 Study 2: Barriers and Facilitators to Collaborative MDTs

Study 2 (summarised in Figure 12) has provided insights into the challenges faced by MDT practitioners in high-performance sports, highlighting uncertainty, role ambiguity, and the need for robust interpersonal skills. Indeed both Salas et al. (2008) and Kozlowski and Ilgen (2006) highlighted the challenges faced by MDTs from different professions. These findings have been supported by Alfano and Collins (2023) who found pressure was a significant factor in poor behaviour of MDT practitioners in sport and Stewart et al. (2024a), who reported role clarity as an important requirement of practitioners working in sport. Our study highlighted that practitioners recognise the importance of diverse perspectives and effective decision-making processes in navigating these challenges. Despite these findings, Study 2 also pointed to a significant gap in understanding how leadership directly influences MDT effectiveness and problem-solving within our context. Leadership is well researched. There is a significant body of evidence underpinning types and styles of leadership (Bonini et al., 2024; Burke et al., 2006), approaches to leadership (Ferkins et al., 2018) and models of leadership (Peachey et al., 2015). In high-performance sport contexts, leadership has also been researched (Arnold et al., 2018; Arnold et al., 2012; Fletcher & Arnold, 2011, 2015) and yet, how leaders leverage MDTs to solve problems has not received attention until now.

4.5.2 Requirements for effective MDT leadership

Building on the findings of Study 2, Study 3 attempts to explore this gap by focusing specifically on the role of leadership in leading MDTs to leverage and maximise their impact. While Study 2 identified some of the difficulties practitioners face, Study 3 aims to explore how leaders perceive their role in overseeing MDTs and what they do. Through this, we will attempt to gain insight into leadership's contribution to performance problem-solving and how they mobilise cognitively diverse teams to solve them. This progression is essential because leadership is pivotal in orchestrating and supporting MDTs within the inherent complexity and uncertainty described in Study 2.

Study 2's recognition of the need for diverse viewpoints and approaches within MDTs extends to an exploration of how leaders can harness these differences to drive team success. Study 3 represents a logical and necessary extension to this line of research, providing an examination of current leader's strategies in to how they optimise MDT performance in high-performance sports settings. By addressing the leadership dimensions that influence decision-making and problem-solving processes, Study 3 aims to bridge an identified gap in the literature and offer practical solutions for enhancing MDT effectiveness.

4.5.3 Leadership of MDT

This logical progression in the research objectives, from understanding practitioner's challenges and views of working in MDTs to exploring leadership solutions, ensures a cohesive narrative throughout the thesis (i.e. Practitioner Lens; MDT Lens, Leadership Lens on problem-solving and decision-making).   It progressively builds on the insights gained from Study 2 to offer a deeper understanding of the factors that contribute to high-performance outcomes in sports.   Study 3 will address the leadership aspects necessary for managing complex MDTs but also set the stage for future research directions that could further refine strategies for optimising team performance in elite sports.

Chapter 5: How do leaders in high-performance sport leverage MDTs to enhance decision-making and problem-solving?

5.1 Overview

In high-performance sport, success is rarely the result of individual expertise alone, it is shaped by the collective efforts of the MDT. In Chapter 3 (Study 1), the role of individual practitioners, examining their decision-making processes and approaches to problem-solving were explored. Chapter 4 (Study 2) built upon this by shifting focus to the MDT collectively, through investigating how practitioners interact, collaborate, and navigate the complexities of team dynamics.

The final study of this thesis aims to examine how leaders in high-performance sport maximise the impact of MDTs and leverage their collective expertise. It seeks to identify the perspectives and views of high-performance sports leaders regarding the role and effectiveness of MDTs in achieving success. Furthermore, Study 3 will explore the strategies and approaches employed by leaders to optimise team performance, enhance collaboration, and fully utilise the diverse capabilities of MDT members. By investigating leadership practices within these environments, this study aims to provide valuable insights into how effective leadership can drive the success and impact of MDTs in high-performance sport.

This chapter extends the discussion further by examining the role of the leader in harnessing, maximising, and leveraging the value of the MDT. Leadership in high-performance sport is a dynamic and complex task, requiring the ability to unify diverse professionals, create high-functioning environments, and guide teams toward effective problem-solving. Through qualitative insights, this chapter explores how leaders navigate the challenges of managing MDTs, balance interpersonal and structural complexities, and ultimately transform collective expertise into meaningful performance gains.

By understanding the strategies leaders use to optimise MDT impact, Study 3 will gain valuable insights into the mechanisms that drive success in high-performance sport. meeting the aims and objectives presented earlier in Table 1, recaptured below.

Study 3	
Question	**How leaders maximise the impact of MDT in high-performance sport and what do they do?**
Study Aim	– Examine how high-performance leaders leverage and optimise the impact of MDTs to drive performance outcomes.
Objectives	1. Identify leader's perspectives and views of MDTs in sport 2. Identify how leaders of MDTs operate and what they do to maximise the value and leverage the expertise and capabilities of the MDT
	See Table 1

5.2 Study 3: From Clarity to Chaos: How Leaders Leverage and Maximise the value of Multi-Disciplinary Team Impact in Elite Sport (under review)

(King et al., 2025)

5.2.1 Abstract

Purpose/Rationale

This study explores how leaders in elite sport environments maximise the impact of multidisciplinary teams (MDTs) to enhance athlete performance and drive organisational success. It addresses a gap in existing literature on leadership's role in leveraging the value of MDTs in complex high-performance sporting contexts.

Design/Methodology/Approach

The research employs a qualitative methodology using semi-structured interviews with eight (n=8) leaders from diverse sports backgrounds. A reflexive thematic analysis was applied to capture rich, contextual insights and to construct a model of leadership strategies for optimising MDT functioning.

Findings

Leaders attend to two interrelated domains: the people domain, which focuses on fostering professional intimacy, establishing high-performance climates, and enabling collaboration; and the context domain, which involves navigating complexity, exercising good judgement, and solving performance problems. Effective leadership requires balancing these domains while exhibiting confidence and adaptability in high-stakes environments.

Practical Implications

The findings provide a framework for leaders and sport organisations to enhance and extract the value of MDT performance through structured problem-solving, clear communication, and alignment of diverse expertise.

Research Contribution

This study contributes to understanding leadership of MDTs in elite sport, offering new insights into how leaders leverage MDTs and attempt to transform inherently complex systems into clarity.

Originality/Value

The study introduces a novel model that identifies what leaders do and what they attend to when leveraging the expertise within MDTs, presenting strategies to manage the complexity and uncertainty that exists in these contexts effectively.

Key Words

Climate; Complexity; Decision-Making; Environment; Leadership; Performance Support Team; Uncertainty; Problem Solving; Professional intimacy.

5.2.2 Introduction

Leadership in elite high-performance sport comes in many forms. Titles of these leaders and their role purpose can differ depending on the sports organisation and its structure however the end goal will be relatively similar, to create competitive advantage that delivers success for athletes, teams and the sports organisations that they work for. Performance in sport is now supported through varying sizes of diverse cross functional multi-disciplinary teams (MDT) of practitioners[10] (Reid et al., 2004). Common terms associated with these teams are inter-disciplinary teams (IDT) (Burns & Collins, 2023), trans-disciplinary teams (TDT) (Vaughan et al., 2019), Performance Support Teams (PST) (Stewart et al., 2024a) and Sports Science and Sports Medicine Teams (SSSM) (Alfano & Collins, 2023). We recognise there is commonality of the goals of these teams and therefore throughout this paper we will refer to MDTs. To mobilise MDTs different methodologies have been proposed. Trans-disciplinary (Vaughan et al., 2019) and Departments of Methodology (DoM) (Rothwell et al., 2020) are approaches that have been adopted in sport and different industries (Brandt et al., 2013). The goal of these approaches is to integrate the work of departments or units where diverse professions work together to solve problems and is most often applied in research contexts (J. Klein, 2008). The language used to describe what MDTs are and how they operate is becoming well socialised across the literature (Alfano & Collins, 2023; Burns & Collins, 2023; King et al., 2024b; Reid et al., 2004; Stewart et al., 2024a) and yet whether it permeates with clarity and is adopted into high-performance sport settings by leaders remains unclear. Whilst there is a body of literature exploring leadership perceptions, styles and approaches in elite sport (Arnold et al., 2018; Fletcher & Arnold, 2011, 2015), it has recently been acknowledged that there is a need for investigation of how leaders of high-performance MDT's in sport leverage and maximise their impact (Alfano & Collins, 2021; Jowett, 2024; King et al., 2024b; Stewart et al., 2024a). Therefore, the aim of this study is to explore how organisations and leaders maximise the impact of MDTs in sport whilst enabling them to generate highly effective and impactful performance support solution.

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[10] When MDTs are referenced, we are referring to Practitioners from diverse Performance and Medical related professional backgrounds such as Biomechanics, Lifestyle, Medicine, Performance Analysis, Psychology, Physiology, Physiotherapy, Sports Science, Strength and Conditioning.

Literature Review

In a recent study, King et al. (2024a) found that individual performance related and medical practitioners tend to toggle between different approaches when seeking to solve problems yet no clear type or problem-solving approach emerged. In a second investigation King et al. (2024b) explored what MDT practitioners do and how they operate within a team. Findings from that work suggest that practitioners must navigate complex problems by making effective decisions whilst collaboratively sharing knowledge in high-performance contexts. Of note was that practitioners recognised the importance of effective leadership and team dynamics in supporting impactful outcomes and to date, this has not been adequately researched (Alfano & Collins, 2021; Jowett, 2024; Stewart et al., 2024b). Furthermore, practitioners valued and recognised the importance of diverse perspectives, skills and ways of thinking (cognitive diversity) (Mello & Rentsch, 2015; Mitchell et al., 2017; Page, 2007) when attending to problems. Applied appropriately, supported by psychological safety (Edmondson, 2012; Edmondson & Bransby, 2023), role clarity and shared understanding across the team, provide important lubricants to effective team working (King et al., 2024b). There is no doubt that to create effective problem-solving teams, good leadership is required (Arnold et al., 2012; Reiter-Palmon & Illies, 2004). Despite good evidence of how 'leaders' i.e. Performance Directors and Managers operate in elite sporting contexts (Arnold et al., 2018; Arnold et al., 2012; Fletcher & Arnold, 2011), there is a dearth of quality literature that explores what leaders do to maximise MDT impact on performance and how they do it within elite high-performance sporting contexts (Burns & Collins, 2023; Jowett, 2024; Stewart et al., 2024a).

Complexity in leadership

Inter-personal Complexity

Leaders must navigate inter-personal (Bowes & Jones, 2006), structural and system complexity in the organisations they work (Balague et al., 2013; Pol et al., 2020). In sport individuals from diverse professional backgrounds are expected to collaborate (Burns & Collins, 2023; Ulrich & Breitbach, 2022). Inter-personal challenges emerge with professional disagreement, personality clashes, conflict, low trust, varying levels of humility, willingness to collaborate and power dynamics all reducing the ability of a team to work together (Cowley et al., 2023; King et al., 2024b). What contributes to these clashes is likely pressure (Alfano & Collins, 2023), a keen desire by individuals within the team to show their impact and justify their position and service provision possibly driven through fear of job security. When departments justify their provision and resources, the system may drive some of the pressure that practitioners feel. Moreover, practitioners may unwittingly compete with colleagues and other disciplines for recognition, credibility and status. Leader's ability to mediate and manage conflict (Kerwin et al., 2017) whilst mobilising diverse teams contributes to their success and drive impactful outcomes.

Structural Complexity

Confounding this issue is the fact that many sports organisations are vertically organised (Terzić, 2018). In these organisational structures, Heads of Disciplines (HoD) oversee specific

teams and their delivery of service. In some cases, the services can be further separated into different divisions, for example a performance and medical directorate. This vertical alignment does not support the horizontal integration of diverse professions as practitioners identify firstly within their discipline team, aligning to their systems, ways of working and processes whilst placing a premium on their service and the expertise that they offer. This presents a challenge for practitioners who might align with and report to a HoD (vertical) whilst simultaneously having a requirement to integrate into an MDT overseen by a cross functional (horizontal) leader.

System Complexity

The systems and processes that teams work through create further complexity. In complex systems theory (Balague et al., 2013; Pol et al., 2020) where elements of a system interact with other elements in that system, significant failures can emerge (Karwowski, 2012; Weick, 2004). When systems have inter-dependencies i.e. the extent to which components of the system rely on each other to function and where they are tightly coupled, for example components of the system are highly dependent on each other, failures can occur and be particularly difficult to identify the root causes (Leveson, 2004; Rasmussen, 1997). When there is little to no buffer or slack between system interactions, changes or failures in one component immediately and significantly impact other components (Rijpma, 2019). Consider the interaction and integration of the cyclical planning and delivery processes between each MDT practitioner to deliver a holistic and integrated programme to the coach and athletes, the organisational structure and the systems that the team works through can breed complexity that leaders must navigate. Furthermore, they must integrate the individual MDTs practitioner's skills, knowledge and expertise which can also implicitly drive this complexity.

Complex Systems in Sport

A complex system is a network of interconnected parts that interact in dynamic, unpredictable ways, leading to behaviours that can't be easily predicted by looking at the individual parts alone (Balague et al., 2013). In elite sport, there tends to be several interacting stakeholders, departments or institutions working together with potentially conflicting values and interests (Sam, 2009) which can lead to ambiguity. At times the problems leaders are trying to address within a high-performance sporting environment aren't simple or clear nor are the solutions (Greenberg & Clubb, 2021). Practitioners typically attend to the most obvious problems delivering traditional 'off the shelf' processes and solutions through servicing, in roles such as Strength and Conditioning, Physiotherapy and Nutrition for example. Familiar problems, stable processes and procedures lend themselves to stable patterns of manual type work (King et al., 2024a; Schraw et al., 1995) and yet, the drivers for the problems that the team are faced with could be far less obvious, difficult to find and very hard to solve. When problems are contentious, turbulent and wicked (Greenberg & Clubb, 2021; Head & Alford, 2015; Rittel & Webber, 1973) or VUCA (Volatile, Uncertain, Complex, Ambiguous) (Vaughan et al., 2019) there may be multiple solutions to multiple problems driven both by interdependent parties (i.e. interactions of all the practitioners) and interacting elements of the system (Alford & Head, 2017). Consider the athlete that presents with re-occurring illness and fatigue when exposed to intensive training blocks, the problematic persistent injury that presents 3 months out from the Olympics or the Coach who wants to predict what speed/intensities of play are required to overcome their opponent at the weekend. The leaders of large MDTs must navigate the

complexity of the system whilst providing clarity to their team and recognise that different types of problems may require different approaches and distinct processes to solving them (King et al., 2024a).

Complexity and Problem-Solving

King et al. (2024a) suggested a framework that plots problem types, problem-solving approaches and decision-making types on continuums that when de-tangled from one another, might offer insight into how high-performance MDT practitioners work. What emerged was a messy picture where practitioners appeared to rely on heuristic (Bennis & Pachur, 2006; Raab, 2012; Raab & Gigerenzer, 2015), intuitive expertise (Kahneman & Klein, 2009; Klein, 1997, 2004) to solve relatively simple problems (King et al., 2024a). MDT staff report decision making as extremely important within their role both as individuals and in teams but highlighted dysfunctional team dynamics and the absence of an organisational strategy as inhibitors to effective decision making (Wilson et al., 2024b). When we consider the problems that each discipline is trying to address and decisions that are being made by practitioners daily, we can see complexity emerge. Decision-making through the lens of the leader must take on a different complexion as they likely lead leaders, such as HoD's, who lead their discipline and practitioners. It is not possible therefore, for the leader to have an awareness of, track and ratify all the decisions that are made by individual practitioners and across teams. This hints at the complexity a leader must contend with and the need for clear strategy and training as suggested by Wilson et al. (2024b). When problem-solving and decision-making become intertwined, the individual, team and organisational processes to deliver each can become muddied making it hard for the leader to understand the outputs that the system delivers and how they were created. The leader may have to contend with uncertainty and elements of risk (Wilson et al., 2024a) where they must display good judgement in their position leading these challenging complex systems.

Leveraging Cognitive Diversity

Cognitively diverse teams outperform individual ability when trying to solve complex wicked problems (Horwitz & Horwitz, 2007; Mannix & Neale, 2005; Page, 2019). Leaders must attempt to leverage the knowledge, perspectives, mental models and heuristics of a team of individuals (Page, 2019). Wicked problems are a by-product of complex systems and potential solutions can take many forms of which the outcomes will be uncertain (Alford & Head, 2017). Often practitioners deliver traditional solutions to traditional problems i.e. deliver intuitively based on their expertise, professional training and evidence-based protocols and procedures (King et al., 2024a). It seems there is a gap in how practitioners deliver service versus how they solve unfamiliar complex problems. This might suggest that leaders would have to create clarity, design processes and build structure through which diverse teams could work together to problem-solve. If this is the case, then we might expect to see different types of work processes operating at different speeds and cadences, cycling in and out across the macro cycle and seasons. These planning processes, the implementation and review of the work (referred to as Plan-Do-Review) in inter-dependent, tightly coupled systems (Rijpma, 2019) is no doubt complex and raises questions about the skillsets and approaches of leaders attempting to deliver the best possible outcomes through their teams.

Leaders must navigate inter-personal, system and organisational complexity (Balague et al., 2013; Pol et al., 2020). The role of leader in establishing performance problems and discovering viable performance solutions is difficult when problems are VUCA and wicked (Greenberg & Clubb, 2021; Vaughan et al., 2019). Balancing operational day to day service delivery and traditional approaches with systemic large scale problem-solving will require a leader to be both close enough to the team to get into the detail whilst remaining strategic, operating at a level where they see and understand all the moving parts. Operating in environments where individuals can be self-serving, and climates can be politically, and conflict charged will no doubt lead to turbulent and volatile environments.

The aim of this study is to identify 'what' leaders attend to and 'how' they operate when leading MDTs in high-performance elite sporting contexts. The objective is to better understand how high-performance sports leaders leverage the capabilities and maximise the impact of MDTs in such environments. By examining leader's insights, we seek to understand their role in enhancing MDT performance and problem-solving capabilities in sport. Our aim is to provide considerations for aspiring and current leaders operating in high performance sporting contexts to maximise MDT impact and to propose a model to summarise our findings.

5.2.3 Methodology

Philosophical Approach

Reflexive Thematic Analysis (RTA) (Braun & Clarke, 2006) can be used effectively to identify patterns in people's practices or behaviours related to, or their views and perspectives on, a certain issue (Sparkes & Smith, 2013). The methodology can be particularly effective when used to analyse semi-structured interviews (McArdle et al., 2012). RTA is a flexible qualitative approach that provides a series of choices and offers diversity in the way RTA is utilised (Braun & Clarke, 2023). The flexibility of RTA allows for a distinction between what (Kidder & Fine, 1987) refer to as 'small q (post-positivist) or big q' (non-positivist, reflexive) qualitative approaches allowing the methodology to be aligned with researcher philosophies (Finlay, 2021). There has been some confusion over the use of RTA as a method rather than a methodology (Braun & Clarke, 2019) with the authors suggesting that researchers should state their ontological and epistemological perspectives as part of the methodology (Braun & Clarke, 2021a, 2023).

The approach used in the present paper aligns more closely with 'big q' research which acknowledges the *active* role the researcher plays in the production of situated knowledge with an inductive, data-driven approach (Braun & Clarke, 2006). As such, we view researcher subjectivity as a valuable addition which should be embraced rather than viewing this as a threat (Braun & Clarke, 2023). Through a relativist ontological lens (Braun and Clarke 2021), people's views, beliefs and experiences shape their perspectives and these perspectives, are their individual and therefore perceptual truths. In adopting this constructionist philosophical stance (Braun & Clarke, 2021a), an interpretivist epistemological (Braun & Clarke, 2019) approach to answering the research question was to adopt a qualitative research design. The methodological approach aligns with the 6 phases outlined by Braun and Clarke (2006). This

approach facilitated the deductive exploration of the views, perspectives, practices and behaviours of leaders working in high performance sport through semi-structured interviews where they each shared opinions, experiences and beliefs through storytelling and sense making, through which, individual and socially constructed meaning could be established (Kallio et al., 2016).

Due to the lack of published research exploring how leaders leverage and maximise the impact of MDTs in elite sport, a methodology was constructed that was inductive enabling the construction of latent meaning (Braun & Clarke, 2019; Kallio et al., 2016) through an iterative approach that is hoped will help drive a broader research agenda in this area in the future.

Ethical Considerations

Ethical clearance was approved by the host university panel (**BAHSS2 0385 –** see Appendix B**).** All respondents read a participation information sheet and provided informed consent prior to taking part. Practitioners were reminded of the ethical considerations and obligations including their right to withdraw, anonymity and confidentiality in the briefing at the start of each interview.

Participants

Eligible participants were recruited from high-performance sport environments through direct email correspondence. Inclusion criteria required participants to be working in or have experience of working as a leader in elite or high-performance sport. Eight leaders working in high-performance and elite sport (male n=7; female n=1) with ages ranging from 45-62 (M=51; SD=5.17) from various high performance sporting organisations and with a diverse tenure; minimum of 8 to a maximum of 21 years (M= 15; SD= 4.5) and range of experiences (Table 8) provided rich discussion across eight interviews. Our leaders have worked in international football, international rugby union, and international cricket; summer Olympic sports, professional football, professional rugby union, professional basketball and in both male and female elite sport leading MDTs. The terms 'high-performance' and 'elite' have been challenged and definitions sought (Swann et al., 2015). McAuley et al. (2022) calls for greater transparency in population samples where the term *elite* is used as such, we aim to provide absolute clarity of our population sample. For inclusion in this study, leaders must have worked or be working in High-performance Professional Sport, World Class Programmes or within a Professional Sports Institute supporting World Class Programme athletes aligning with what Swann et al. (2015) classify as Level 4 when defining elite.

Care was taken to select leaders with a diverse array of experiences from a variety of sporting contexts to enable us to capture data that has richness, depth, diversity and complexity (Braun & Clarke, 2021b) and from varied environments. In line with the account provided by Trainor and Bundon (2021), we initially planned to recruit 12 leaders. Of the twelve leaders that agreed

to take part in this study four (n=4) withdrew for various reasons (n=2; no reason given; n=1; change of job; n=1 work pressure). In line with Braun and Clarke (2021b), we align with the argument that data, thematic and code saturation are coherent with neo positivist discovery orientated thematic analysis and are not consistent with the assumptions (i.e. assumes subjectivity and reflexivity and favours thematic coherence and sufficiency) of reflexive thematic analysis (Braun & Clarke, 2019). Indeed Braun and Clarke (2021b) point out that meaning is generated through interpretation and construction of, not excavated from data. Judgements about 'how many' data items, and when to stop data collection, are both 'situated and subjective', and cannot be fully determined in advance of the analysis. Therefore, the leaders that we could get access to, and our sample is pragmatic and enabled codes and themes to be well established.

Semi-structured interview schedule

We devised a schedule consisting of seven open ended questions to form a semi-structured interview script (Table 7). The questions were shaped to illicit interpretation by each individual and in keeping them brief and open, avoided supposition that might have constrained responses (Lucas, 2014).   In line with the 5-stage framework produced by Kallio et al. (2016), the interview structure was designed, piloted and refined. Although there was structure and a design to the interview, the flexibility of RTA enabled each leader to share, explore and meander through the questions whilst the researcher was able to reflexively react to the conversations probing further (using 'how do you do that' or 'can you provide an example' questions) as and when required or when something was of interest. An approach that is supported within the framework and aligns with Braun and Clarke (2023) guidelines for developing sound methodology.

Table 7: Questions used in the semi-structured interviews to stimulate discussion

Number	Question
1	Describe your role, organisational structure and what's your definition of a MDT?
2	Collaboration is much used value within sporting organisations: Is collaboration important and how do you encourage it across the MDTs you lead?
3	Sharing is a term associated with high functioning teams: Is 'sharing' important and what does this look like across your MDT?
4	Innovation is a buzz word in sport now-a-days: How important is creativity and innovation to you and how do you encourage it in your department?
5	Is decision making an important requirement of your role and what does this look like in your work?
6	Do you differentiate between decision making and problem solving and how do you go about solving problems?
7	What are the skills and behaviours required for practitioners to be effective within an MDT?

Table 8: Semi-structured interview and participant information

Leader Code	Relevant Collective Experience	Combined Years in elite/high-performance roles
L1	Head of Performance – NGB – IPF Performance Director – NGB - SOS	19
L2	Head of Men's Performance - NGB – IPF Director of Performance Support - PL Director of Performance Support – NSI	10
L3	Academy & Pathway Consultant – International NGB – PS Performance Team Director – NSI Head of Sports Science and Medicine – NGB - SOS Sports Science manager – NGB – PS	17
L4	Director of Performance Support and Science – NSI Head of Performance Nutrition – NSI	11
L5	Director of Performance Services – NSI Head of Academy Sports Science – PL Strength & Conditioning National Manager – NSI	8
L6	High Performance Director – PS High Performance Director – PS High Performance Director – PS	15
L7	Senior Manager; S&C and Nutrition – NSI Head of Performance – PS Head of Performance – NGB – IPR National Lead for S&C – NGB – PS	14
L8	General Manager – Athlete Performance Support – NSI Head of Performance Therapies – NSI Head of Physiotherapy – NSI	21

Footnote: Our sample of high-performance leaders have worked in a variety of contexts with well recognised sporting brands. To protect the individual's anonymity the leader's role titles have been listed and their affiliations kept broad.   Our leaders have worked in International football, international rugby union, and international cricket; summer Olympic sports, professional football, professional rugby union, professional basketball in both male and female elite sport.

IPF: International Professional Football; **IPR**: International Professional Rugby; **NGB**: National Governing Body; **NSI**: National Sports Institute; **PL**: Premier League Football; **PS**: Professional Sports; **SOS**: Summer Olympic Sports

Each interview was conducted through Microsoft Teams® (Microsoft Corporation, Washington, USA) where it was recorded, transcribed, encrypted and stored electronically and securely on the university network before being analysed.

Data Analysis

Each semi-structured interview lasted between 66 and 97 minutes (M= 78.6 mins; SD = 8.89). In line with the 6-stages provided by Braun and Clarke (2006), the recordings and transcription were reviewed to become intimately familiar with the data. The data was initially coded, and the coding refined as the researcher analysed and reanalysed the transcripts in an iterative process creating codes from sentiments expressed from key words and statements used by the participants. The words and statements enabled the creation of sub themes and themes. To support an iterative reflexive process and to challenge individual biases, the co-authors then reviewed transcripts, then themes and subthemes probing, asking questions, discussing the sub theme groupings and themes with the lead author. The objective was to add interpretative depth with nuanced perspectives based on the co-authors and authors varied experiences in

elite sport. These views allowed the researchers to reflectively refine the themes and subthemes and was supported through the use of reflective journaling, voice notes and whiteboarding which allowed the author to continually interact with the data providing reflective depth and nuance to the analysis. This iterative process was repeated across all interviews and following the recommendations by Naeem et al. (2023) a thematic map (Figure 13) was created supported by the statements and quotes that supported the creation of the subthemes and themes which are presented in Table 10 and Table 11.

5.2.4 Results

Following the approach discussed by Braun and Clarke (2006) and similar to that used by Naeem et al. (2023), a thematic map and model illustrating how leaders leverage MDTs in sport (Figure 13 and 14) has been created supported by relevant quotes displayed in Table 10 and 11. It was important to first understand the leader's views and perspectives of what a MDT is and its value in high performance and elite sporting contexts, these views are summarised in Table 9 and supported by quotes. The methodological approach, including thematic analysis, coding, summaries, and presentation of the results, was compared with Braun and Clarke (2006) 15-point checklist for good thematic analysis, enabling further reflection on the methods, results, and summary findings.

Table 9: Leaders views on the terminology and practices of MDTs working in high performance and elite sport.

| View	Theme	Quote	Leader Code
Benefits of Multi-Disciplinary Team	**Integration and Collaboration:**	"Multidisciplinary, I've always seen as sports science/sports medicine practitioners integrating with the technical coaches."	L1
		"So, making sure that programme planning was integrated into what the coaches were thinking, what the sports science/medicine elements were thinking and how they plan together.	L1
	Value of Diverse Expertise:	"I think in a multidisciplinary situation, we've put together a group of individuals, a group of disciplines, people with different expertise."	L3
		"I think certainly in sport, all those diverse views from all those different professions, you're almost missing a trick if you're not tapping into their creativity, because actually, you start to smash those different worlds together. Anything could come out."	L4
		"A group of individuals that are performance, sports science, medical, and yet there should be an overlapping of skill sets amongst all of those disciplines."	L6
	Enhanced Performance and Effectiveness:	"Effectively the combined skills of multiple people can consistently produce a better output than the same number of people working in isolation."	L7
		"It's the combined efforts of the people in that team to share information, intel, that will be supportive of one another's efforts understand the priorities for the recipients of the services at any particular moment in time."	L7
	Integration Over Isolation:	"Multidisciplinary team sits on a spectrum, which is the opposite of a whole series of people working in isolation."	L7
		"Inter-disciplinary, you start to integrate the disciplines together."	L8

Ambivalent or Critical Views	**Differentiation Between Multi-Disciplinary and Interdisciplinary:**	"I often choose to use a term interdisciplinary because I think that relates to embracing the overlap of the skill sets that happen between those groups."	L6
		"The difference between interdisciplinary and multidisciplinary, which it seems really straight forward, just basically working well."	L2
		"These terms like multidisciplinary and interdisciplinary, there just good teams, just effective teams. It's simple as that."	L2
	Evolution of Terminology:	"I don't really care what the technical term is. For me it's about getting those diverse views, those diverse professions working together on behalf of athletes, coaches."	L4
		"Not a fan of people playing with words to create new knowledge. I would only consider those terms as I understand them to represent the evolution of how the industry has thought about the way it works overtime."	L5
Against Multi-Disciplinary Team Views	**Preference for Interdisciplinary**	"It's the combined efforts of the people in that team to share information, intel, that will be supportive of one another's efforts understand the priorities for the recipients of the services at any particular moment in time."	L7
	Transdisciplinary	"Working as an interdisciplinary/transdisciplinary team, should be an obvious thing to do… if you find yourself with reasonably intelligent people and you're spending an excessive amount of time trying to solve a problem, you're probably trying to solve the wrong problem."	L2
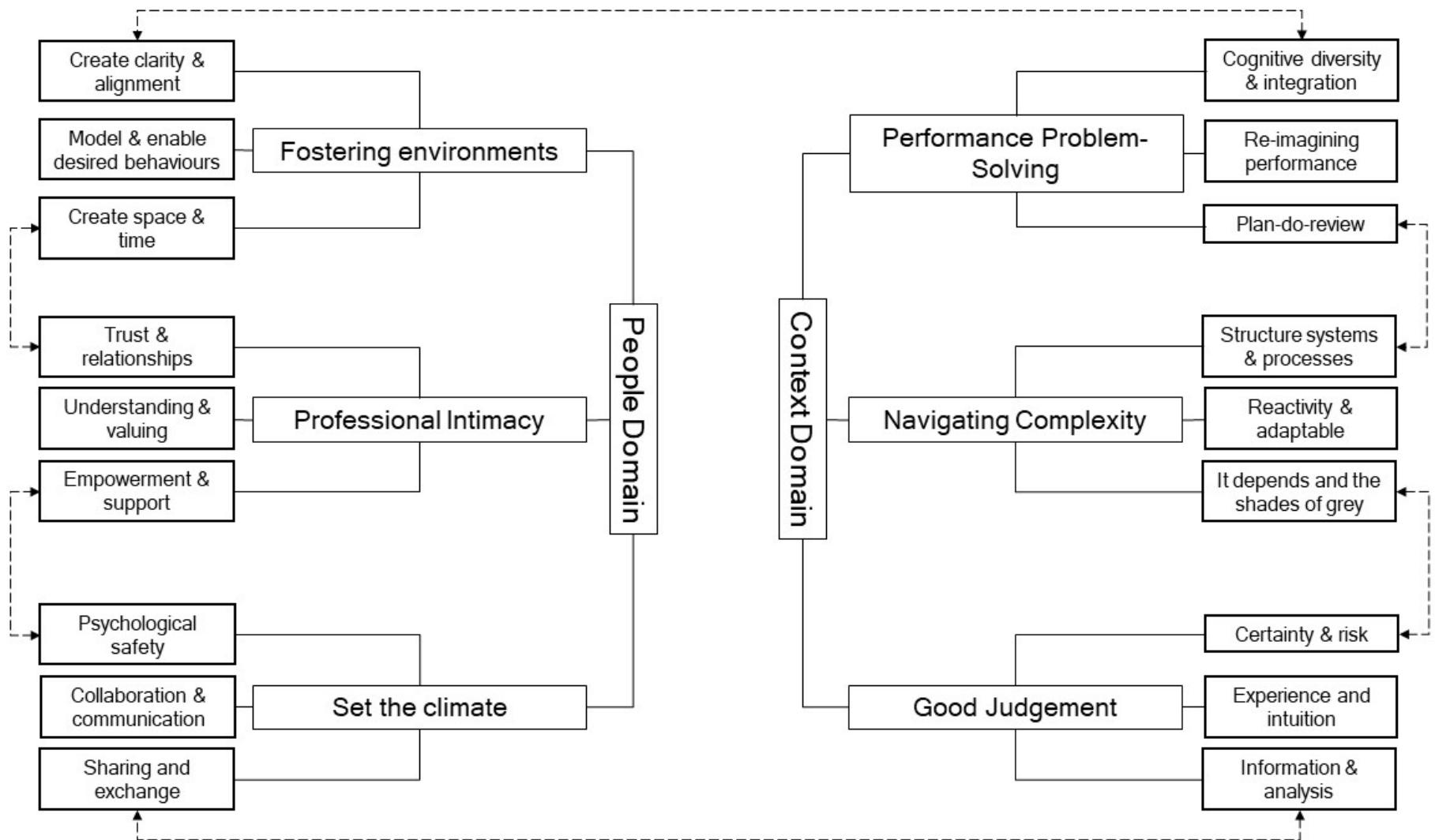
Figure 13: The leadership lens: Thematic map outlining themes and subthemes of the people and context domain.

The leaders lens focuses on an interdependent people and context domain. In the people domain, the leaders create psychologically safe environments and sets climates where cognitively diverse teams can be leveraged to solve performance problems and deliver the best performance outcomes. To do this, the leader must navigate organisational and system complexity utilising information, analysis and the input of the MDT using judgement to attempt to make effective decisions. These decisions carry uncertainty and risk; therefore, leaders must weigh innovative solutions with effective delivery through cyclical planning and delivery processes.
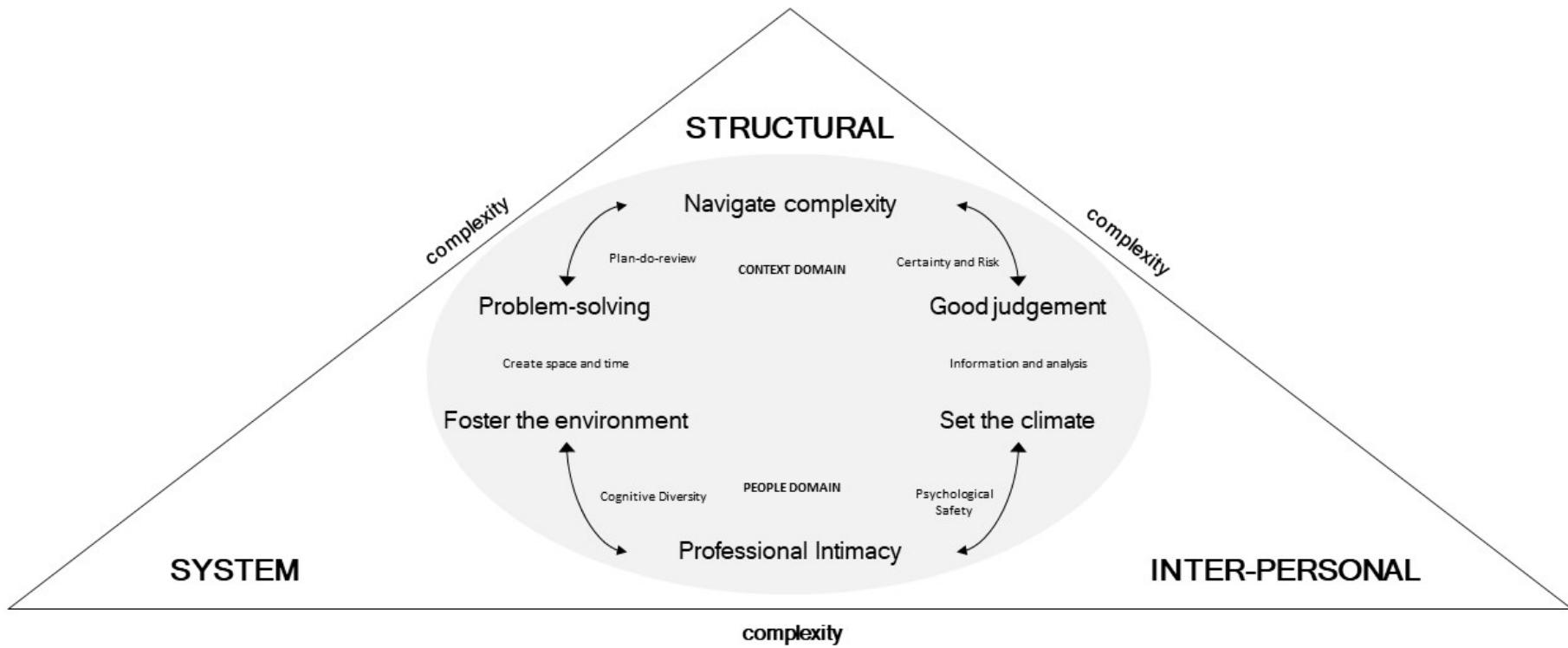
Figure 14: The Leadership Lens: Leveraging MDT's in high performance sport.

Leaders operate within system, structural and inter-personal complexity that is both contextual and environmental. Depicted in the figure is the people and context domains that leaders attend to and each of the subthemes (Figure 13). Linking the domains and themes are key sub theme codes that leaders expressed as important.

Table 10: Leaders quotes that support the identification and coding of sub themes and themes (People Domain).

Domain	Theme	Sub Theme	Quote	Leader
People Domain	Fostering Environments	Create clarity & alignment	If you come together and spend a lot of time really clearly defining the problem, working out what's the problem we're trying to solve, what's the goal here? We establish real clarity before rushing off into action.	L2
			Trying to set expectations, there's also different personalities, some who need absolute clarity of what you're trying to achieve.	L4
		Model & enable behaviour	Clearly an element of role modelling things. I'm leading by example and so if they see leaders collaborating effectively with all the stakeholders, then it sets the tone.	L7
			Early practical experience and then some coaching. There's an element of feedback. What worked what didn't work and helping people to make sense of it.	L3
		Create space & time	Creating a space where people feel they can freely share their ideas and thoughts is crucial for innovation. It allows for a diverse range of perspectives to be considered.	L6
			We need to give ourselves time. In the year in the week in the month to allow ourselves to be creative and be open to new ideas. Sometimes you just need the space to allow yourself to think freely around a problem and that will create ideas.	L3
	Professional Intimacy	Trust & relationships	Allow the people who need to work together to understand each other deliberately. Understand and value each other. Deliberately finding time to get to know each other. Will that be socially within meetings, work, whatever.	L4
			I recognise that a lot of my behaviours around trying to form a really strong, trusting, respectful relationship with each of the people in the team and then trying to use my influence to spill it over, to tip it into each other.	L5
		Understanding & valuing	It's asking questions and showing interest. At the core of it it's a curiosity in the people and it's a curiosity in the problem.	L3
			You're values and the skill sets and the way that you conduct yourself, your ability to communicate with others, your ability to listen to, respond appropriately to, remain optimistic when everything's turning to verbal.\nYour values, your personal values, the things that you hold dear, I will question quite a lot	L8
		Empowerment & support	So if you've got good people in the team how do I keep them inspired, energised, valued, engaged. The priority being the people and if I have the best people working in the team around the athletes then the other stuff will come.	L3
			How your approach as the leader to empowerment. If you empower but abdicate, then you're not a leader because things will go on and you'll lose sight of what's coming on.	L1
	Set the climate	Psychological safety	One of the fundamental conditions that enable practitioners and employees to work well is having sufficient psychological safety in an organisation to be able to contribute effectively.	L7
			I think there are some deliberate things you need to do as a leader that creates safety in a team and I think it's being deliberate about it, not least showing your own vulnerabilities and set of expectations. What you want people to do, I think it be very deliberate about that.	L4
		Collaboration & communication	What has created the most collaboration is having the people who either respect or like some positive aspect of a personality that enables people to connect when they come together, if you don't have that piece people generally aren't collaborating.	L5
			It's the collaboration about more complex issues... like how are we going to move performance onto the next level, how are we going to achieve that time… that's where collaboration is more important, but equally more challenging.	L3
		Sharing & exchange	It is the combined efforts of the people in that team to share information, intel, that will be supportive of one another's efforts understand the priorities for the recipients of the services at any particular moment in time.	L7
			If you don't listen you actually lose a lot of the ability to share anything because you actually have not understood the person, the human that's in front of you and their readiness to share themselves.	L8

Table 11: Leaders quotes that support the identification and coding of sub themes and themes (Context Domain).

Domain	Theme	Sub Theme	Quote	Leader
Context Domain	Performance Problem-Solving	Cognitive diversity and integration	Performance doesn't sit in a nice box. So when you've got those diversity of professions. They will all without some impetus to collaborate see the world through their lens. You need to create a really safe culture where people can feel like they can express their own views either personally as them or as their profession.	L4
			Everybody understanding each other to a greater extent and understanding what's around them and in some places, where they should differ, in some places where they naturally overlap and align, in some places where there's some merging that's going to lead to a slightly different answer that neither of you would have as your start point.	L5
		Re-imagining performance	Yes, do innovation, do creativity, always work on something that's going to make a difference, but have a clear timeline of when that has got to stop before it impacts or doesn't impact in a major sporting environment.	L1
			(re) imagine the next level of performance that might be required to win. Requires a degree of innovative creative thinking about the problem.	L3
		Plan-do-review	Being really rigorous on the prioritisation of what we're doing together, and be really brutal on the prioritisation, I guess at the heart of both of those is the Plan-Do-Review process Plan-Do-Review both in what you're doing and how you work together,	L4
			Particularly my reference to Olympic Games, World Cups or Commonwealth, the decisions before that would have been planned out through the PLAN-DO-REVIEW model.	L1
	Navigating Complexity	Systems, structure and process	It's a complex system of things joined up together and for us to artificially address those things in separate ways creates a lot of tension.	L8
			We've kind of learned from business how to set up systems and structures and processes, and we've forgotten what it is to play by the rules of sport.	L8
		Reactivity and adaptable	Whatever sport we're working in is its own complex system that's always changing and it's always evolving.	L6
			Our system is quite reactive because we think that's agile. Making a decision for today that doesn't think about tomorrow or next year, or five years time actually creates way more problems, time and time again.	L8
		It depends and the shades of grey	People want really clear decision making and they think most decisions should be black and white. What I've tried to bring to our department is that most decisions are along the spectrum of grey. It's never as clear as this is definitely the right decision, and this is definitely the wrong decision.	L6
			Sometimes you make a decision where I don't know really what this is going to fully look like, but if I don't make the decision now, we're never going to get anywhere.	L1
	Good judgement	Certainty and risk	Embracing that elite sport is this constant VUCA environment that you make decisions not even knowing whether there was right or wrong. You may not know till weeks later if that was a right or wrong decision. And we have to be psychologically prepared for the fact of we don't know.	L6
			I didn't mention risk but I think risk is important to weigh that up. And sometimes you have to weigh that up really fast. And then you decide on a fast, low decision, but it's the weighing up all of the risk that not everybody's good at and I think really good leaders can weigh that up quickly.	L4
		Experience and intuition	You know what they normally say is gut instinct, go with the gut instinct. Good judgement will always follow.	L1
			And so with experience and expertise you can take all of those factors into account and then, through (what I feel it's like intuition). Come up with what? That right thing to do on that day.	L6
		Information and analysis	If you make a mistake or something, a decision that you make turns out to be a mistake then that is probably going to be because of some kind of gap in the knowledge or the information or whatever you had at the time, which subsequently has emerged since you made that decision.	L7
			So if the thinking is clean and clear behind decisions based on what we knew and what was at our disposal at the time, we did the right thing as opposed to we've made the wrong decision.	L2

5.2.5 Discussion

The aim of the current study was to identify 'what' leaders attend to and 'how' they operate when leading MDTs in high-performance elite sporting contexts. This allowed us to achieve our stated objective which was to understand how high-performance sports leaders leverage the capabilities and maximise the impact of MDTs in such environments. It was important to understand leader's views of MDTs and their perceived value which is summarised in Table 9. A thematic map (Figure 13) and model (Figure 14) was developed illustrating the themes and sub-themes which are supported by relevant quotes (the codes that created the themes) and are displayed in Table 10 and 11. Reflective thematic analysis (RTA) was applied to the interview transcripts of eight leaders working in high performance sport. Through this flexible methodology we found that leaders attend to a context domain (the 'what') consisting of navigating complexity, performance problem-solving and good judgement. A people domain (the 'how') made up of professional intimacy, fostering environments and setting the climate. Leaders must navigate through and operate within inter-personal, system and structural complexity (Figure 14) which suggests that they contend with wicked and VUCA problems. Furthermore, our study suggests leaders must contend with uncertainty and risk relying on good judgement, intuition and experience alongside information and analysis in navigating this complexity. Our model may act as a framework through which sporting organisations and leaders could assess whether they effectively leverage each practitioner and the MDTs performance problem-solving capability to enhance sporting outcomes. Further investigation into the strategic and operational problems leaders face within their context/environment would perhaps illuminate 'why' they operate in certain ways further enhancing the findings presented in this study.

Leadership and their definitions of MDTs

Findings in the current study suggest that leaders often have differing opinions about the value of MDT (Alfano & Collins, 2023; Reid et al., 2004), IDT (Burns & Collins, 2023), and TDT (Vaughan et al., 2019) working (see quotes in Table 3) both valuing the diverse expertise within the MDT and the better outputs this offers whilst being ambivalent to terms and terminology. Leaders use the terminology interchangeably often viewing the MDT as 'simply good teamwork'. As Leader 4 stated "*I don't really care what the technical term is. For me it's about getting those diverse views, those diverse professions working together on behalf of athletes, coaches.*"

Our leaders identified benefits and challenges of the MDT approach and didn't convey a strong alignment with the research base underpinning the use of MDTs. Whilst leaders strongly recognise the value of diverse skills sets in supporting performance, they didn't necessarily articulate how they purposefully leverage MDTs to attend to ambiguous or clear problems somewhat relying on the team functioning well implicitly. Leader 2 stated:

> *"Working as an interdisciplinary/transdisciplinary team, should be an obvious thing to do… if you find yourself with reasonably intelligent people and you're spending an excessive amount of time trying to solve a problem, you're probably trying to solve the wrong problem."*

Despite strong views on how individuals from different disciplines might work together, leaders gaining greater clarity on the utility and purpose of MDT working and when to apply it might yield greater returns. Integrated team working can sometimes overpromise and under deliver in terms of output and impact (Burns & Collins, 2023; Stewart et al., 2024a) thus, leaders should recognise and exercise judgement in how they apply and deploy true MDT working. Leader 4, referencing the value of expertise said *"I think certainly in sport, all those diverse views from all those different professions, you're almost missing a trick if you're not tapping into their creativity, because actually, you start to smash those different worlds together. Anything could come out."*

Leadership and Structural Complexity

This study suggests that leaders work within vertically aligned organisational structures. Many of our leaders talked of structure, systems and processes as complex (Zaccaro et al., 2012) and raised challenges associated with silo'd working (Alfano & Collins, 2021). Leader 6 said *"If you sit in the room with like-minded people and you're in your discipline and you don't mix with the other disciplines, that can become very insular very quickly."* And yet, they went on to *say "When it comes to procedural side. Um, that's where I probably lean more on my leaders within the different disciplines within disciplinary teams."* Perhaps exacerbating the insular silo's that they referenced rather than breaking them down.

Organising teams within traditional vertical structures (Sotiriadou, 2013; Sotiriadou & De Bosscher, 2018) often aligns them strictly with their individual disciplines. Practitioners in these structures report to a HoD, who oversees their specific service. This arrangement presents three significant issues. 1. Practitioners primarily identify with their own service area, which fosters a narrow focus. 2. Their deep, specialised expertise becomes poorly understood and less accessible to the rest of the team. Additionally, 3. Individual disciplines end up competing against each other (Reid et al., 2004), which may create inter-team challenges as they attempt to demonstrate value and impact over their colleagues as leader 3 states*: "Sometimes the dynamics in high performance sport where there's pressure for results. Um, outcomes can make it, you know, very task driven. People* [referring to practitioners] *can feel under pressure to deliver and that changes behaviour"*

To address these challenges, leaders should consider adopting a horizontally integrated model. This approach encourages practitioners to align with the multidisciplinary team (MDT) rather than their specific discipline. It ensures that team members apply their expertise collaboratively, working towards clear, aligned, and transparent goals and processes (Stewart et al., 2024a) both of which, our leaders report as important elements within their approach.

> *"You need to create a really safe culture where people can feel like they can express their own views either personally or in their profession. You need that common goal, strategy, anchor, whatever it is that you gonna go after, and then as a leader, you got to be bloody persistent."* (Leader 4)

By deploying leaders to manage MDTs instead of individual disciplines, the structure becomes more collaborative (Alfano & Collins, 2021; Rothwell et al., 2020). This reorganisation helps

leaders navigate conflicts and challenges arising from discipline-specific silos, reducing competition and enhancing overall team cohesion and effectiveness towards organisational and performance problems.

Leadership and System Complexity

In this study we found that leaders work to integrate the disciplines, creating clarity and aligning team members when required. Leader 1 approached this through integrated collaborative planning stating *"So making sure that programme planning was integrated into what the coaches we're thinking, what the sports science/medicine elements were thinking and how they plan together."* Leader 2 looked for alignment through the sentiment and words of practitioners remarking "*And if I hear the same golden thread in everybody's own personal words, but it's lined up rather than 'I'm the guy that gets them strong or whatever', then you're probably onto a winner.*"

Leaders should consider when a multidisciplinary approach is necessary. Practitioners often address simple or tame problems using intuitive expertise and procedural methods (King et al., 2024a). In such cases, involving the broader MDT unnecessarily adds complexity to the system. When tasks can be managed through protocols, procedures, and checklists, effective communication across teams suffices. Leader 8 makes the point, *"You get experts in a room who have been used to knowing more than everybody else and they use that knowledge to the detriment of the person that they're giving it to."* A mono-disciplinary approach reduces inter-dependency, creates slack between departments, and decouples areas of work where integration is not required (Sorenson, 2003). In these cases, the leader can perhaps be seen as an orchestrator (Jones & Wallace, 2006), coordinating and aligning the work of the different disciplines as opposed to a mixologist, blending expertise to solve novel problems.

Leaders should focus on tasks that genuinely need multi- or interdisciplinary collaboration. For these tasks, setting up teams to collaborate, problem-solve, and work together can lead to better and more effective outcomes. Leader 2 remarked *"If you come together and spend a lot of time really clearly defining the problem, working out what's the problem we're trying to solve, what's the goal here? We establish real clarity before rushing off into action."*

In this study we found that leaders attend to this through special projects, deliberate 'plan-do-review' cycles, and purposeful 'problem finding' enabling leaders to leverage cognitive diversity (Page, 2019) and true MDT working where it is truly beneficial. Leader 3 encapsulated this nicely saying:

> *"Probably different types of collaboration. Planning, reviewing and discussion around how we're helping an athlete… when we're in delivery mode, we can still collaborate in that environment, it tends to come easier, right... I see an athlete or coach or a teammate struggling, and I step in to help them and support them in what they're doing.*

However, it is important to recognise that cognitive diversity (Hong & Page, 2004; Mello & Rentsch, 2015) is not a cure-all and can be costly; thus, collaboration should be used judiciously. As leader 2 stated *"Collaboration is expensive. It's not the panacea to everything. It takes more time, it takes more energy. It takes more effort. I think it should be used skilfully and sparingly, like any tool."*

When leaders view MDT/IDT work as a resource for problem-solving (King et al., 2024a; King et al., 2024b), they can separate these processes from day-to-day operations. Creating space, time, and a clear purpose for collaborative problem-solving using appropriate methods, such as design thinking (Maiden et al., 2023; Santos et al., 2016), will differentiate workflows. Whilst the leaders in this study recognised the importance of creating time and space for practitioners to reflect, think about problems and problem solve together, there was recognition that it was a fine balance between getting the work done and thinking about what work needs to be done.

Leaders in our study seem to distinguish between procedural tasks (King et al., 2024a) and innovative work (Santos et al., 2016), enhancing overall efficiency and impact and most importantly, give practitioners time, space and the appropriate conditions to either look for, think about or provide solutions to difficult problems that need to be addressed. What seems to be challenging, is supporting the MDT to engage in the right kind of work at the right time in the cycle. Our leaders appear to rely on cyclical processes of plan-do-review aligned to the season of the sport. As Leader 4 states:

> *"Bring really rigorous on the prioritisation of what we're doing together and be really brutal on the prioritisation. And I guess at the heart of both of those is almost like the Plan-Do-Review process. Plan-Do-Review both in what you're doing and how we work together,"*

Leadership and Interpersonal Complexity

Through this study it was identified that managing a team of individuals with diverse preferences, biases, beliefs, skills, and experiences is inherently complex. Effective communication is crucial (Eccles & Tenenbaum, 2004), yet often challenging, as individuals may prioritise personal gain over collective success where practitioners struggle with role purpose, job security, fear and pressure. This self-serving behaviour can create conflicts, especially when personal differences or affective conflicts arise (Salcinovic et al., 2022; Stewart et al., 2024a). As leader 6 points out *"It can cause lots of conflict if you have really highly skilled practitioners who have a strong overlap of expertise who all want to be doing the same things within your team."*

Additionally, when team members with radically different skills are forced to collaborate without clear goals, it can lead to power struggles and point-scoring (Roncaglia, 2016). This aligns with the finding that leaders must create environments with clear, aligned objectives (Arthur et al., 2017). By setting a vision, defining outcome and process goals, and clarifying each team member's contributions, interpersonal conflicts can possibly be mitigated (Alfano & Collins, 2021). Leader 1 states:

> *"So, your vision, your mission, objectives have been clearly defined and the strategies across that would have been done within the tactics people would take. Or staff would take responsibility for those tactics with a timeline to be delivered."*

Our leaders coach, provide feedback, model desired behaviours (Smith et al., 2013), and foster trust, respect, and shared values with their respective teams (Salcinovic et al., 2022).

In high-stakes, competitive environments such as sport, political dynamics (Kerwin, 2013; Kerwin et al., 2017), and the pressure to win (Alfano & Collins, 2023) can stifle open communication. Practitioners may withhold opinions and solutions to avoid conflict (Barki & Hartwick, 2004), reducing the team's problem-solving capacity. Since roles in elite sports are highly competitive, individuals may focus on demonstrating their worth and securing their positions. We found that leaders attempt to foster psychologically safe, collaborative climates (Edmondson, 1999; Edmondson et al., 2004) where team members can speak candidly and share without fear of repercussions. Leader 3 gave the example *"in highly functioning teams, you know, athlete, coach and anyone in the team has an opportunity to raise problems and to be heard and also to then work together to create the solution."*

This is particularly challenging in results-driven contexts, where losing can have serious consequences. Building psychological safety takes time and requires high trust, low ego, and effective collaboration (Edmondson et al., 2004). The leaders who participated in this study develop close, trusting relationships with each team member, understanding their needs and empowering and supporting the entire team. Leader 5 talked about trust and relationships stating:

> *"I'm quite reliant on my own ability to build very good relationships with people. I recognise that a lot of my behaviours around trying to form a really strong, trusting, respectful relationship with each of the people in the team and then trying to use my influence to spill it over, to tip it into each other."*

By developing professional intimacy with each individual and across the team, the leader can mediate and foster meaningful relationships and smooth conflicts that can support effective team working.

Leadership and Good Judgement

Sport is inherently unpredictable (Wilson et al., 2024a). In high-performance elite sport, significant time, effort, and resources are invested in striving to make outcomes more certain. Leader 6 refers to this unpredictability:

> *"Really embracing that elite sport is this constant VUCA environment that you make decisions not even knowing on the day whether there was right or wrong. You may not know till weeks later if that was a right or wrong decision. And we have to be psychologically prepared for the fact of we don't know."*

Leveraging sport science and innovation to achieve new performance levels is now the rule, not the exception (Stewart et al., 2024a). Our leaders spoke of reimagining performance, recognising that to win, it is necessary to innovate and reach new heights that have never been achieved before. This suggests that teams should constantly create new methods, ways of working, and innovative approaches. Leader 3 said *"(re) imagine the next level of performance that might be required to win. Requires a degree of innovative creative thinking about the problem."*

However, this often conflicts with practitioners' professional bias, i.e. their tendencies to rely on previous experiences that has led to positive outcome or applying their traditional 'tried and tested' solutions for traditional problems (King et al., 2024a; Schraw et al., 1995). Despite these efforts, outcomes are never guaranteed, and results remain unpredictable. Rather than trying

to fit the environment to the solutions, it is important that leaders contextualise solutions that fit within their environment as leader 8 states: *"having rationale, having context, bringing all the people you need to assess the problem and then committing"*.

Findings of this study suggest that leaders are expected to lead with certainty, confidence, and deliver results. Yet they must navigate uncertainty and risk (Aspers, 2018) with varying levels of confidence (Collins et al., 2015; Martindale & Collins, 2013; Wilson et al., 2024a) at times when failure and things going wrong is inevitable. They must make decisions, solve problems, give advice, and deliver support across multiple departments, divisions, and individuals. The following passage from leader summarises this.

> *"You've got what the player is telling you themselves overlaid with what you understand about their own personality, overlaid with what you understand about their current context. You've got a doctor who has an opinion, which you overlay on that individual's level of risk aversion, and then you've got the overall context of how's the manager gonna be... how much of a gamble do we want to take on this? There are so many things going into that. And then it's a huge skill to be able to take all of that and go, this is what we're gonna do and this is why."*

Given the complexity of interdependencies and couplings (Balague et al., 2013; Pol et al., 2020; Rasmussen, 1997) between practitioners, departments, divisions, athletes, coaches, and teams, leaders cannot always be aware of everything, at any given time.

Several of the leaders in this study suggested they were very comfortable operating in uncertain and risky environments. Leader 4 stated *"I'm really comfortable with uncertainty but for others, they absolutely hate it, so if I overplayed that I can really affect others."* While the proliferation of data can offer a false sense of confidence, leaders need to access information, review data, and analyse it to support decision-making. There is a false sense of confidence that comes from relying on data as it can be manipulated to support our arguments and interpreted in a way that confirms biases.

> *"There's so much information these days… when you go back retrospectively, you will always find stuff. Therefore, it shows you that you are always missing stuff. The narrative conversations which are used in the moment but aren't captured anywhere for retrospective analysis. I think there's massive potential for that."* Leader 6

However, our leaders also rely on experience and intuition (Kahneman & Klein, 2009), acknowledging the 'shades of grey' and 'it depends' nature of decision-making (D. Collins et al., 2016). Being decisive and making critical decisions while empowering others to make their own decisions appears to be a key characteristic of effective leaders. An example provided by Leader 8 is *"So I'm very driven to empower someone, leave somebody with something that makes them feel fuller, feel more confident. Leave the room with more positivity to go and address the problems themselves.*

Balancing the leader's judgement with the need for transparent and consultative decision-making is crucial in elite sports. Leader 7 remarked:

> *"If we're on the part of the continuum where there are multiple people with multiple skills and expertise contributing to the decision-making process. Then, ensuring there is open, clear communication, that everyone's got the opportunity to hear the current*

> *narrative story of what's happening to the athlete and add value to that and then make a value judgement based on what the options are that we've got available to us*."

Remaining reactive and adaptable when working with process-oriented deliverables is a challenging tightrope to walk, yet it is essential for success in high-performance contexts.

Leadership and Problem-solving

Further investigation into the types of problems leaders typically face in their context/environment and how they go about solving them through the MDT would be beneficial. Considered in the idiosyncratic context (is the team winning or losing) and environment (what resources does the leader have) or through the goals that are set by leadership for the team, the leader faces multi-faceted and relatively unique problems. Leader 4 describes:

> *"You can have to make a decision, depends on the problem and how big that is. But almost that stacking of solutions will hit a resource barrier. Other people, time, money, energy, change capacity whatever you want to define that as, so you have to make a decision to stop stacking solutions."*

Developing support and approaches that enhance decision making and problems solving capability of leaders might be advantageous as it was clear that despite the frequent use of the language of problem-solving and decision-making, these terms were used interchangeably and without clear intention by our leaders.

Our study found that leaders rely on 'plan-do-review' processes to organise the work of the MDT. Leader 1 said when talking about leading the MDT and how decisions were made *"Particularly my reference to Olympic Games, World Cups or Commonwealth, the decisions before that would have been planned out through the PLAN-DO-REVIEW model."* Whilst Leader 4 referring to problem-solving said, *"If you've kind of got that really good PLAN-DO-REVIEW type process. You will find problems and you will learn through those problems."*

There was strong consensus across all leaders that in high-performance sport, that the purpose was to stay ahead of the competition, delivering results that have never been seen before and that to achieve this, integration of cognitively diverse teams is required. Set against the system complexity that has emerged through this study, the spectrum of problems leaders might be grappling with and the apparent procedural type work that MDTs engage in, leaders likely will rely on satisficed (satisfy the minimum requirement necessary to achieve a goal) rather than optimised solutions (Gigerenzer & Gaissmaier, 2011; Raab & Gigerenzer, 2015) which may be achieved through operational 'day to day' delivery as opposed to purposeful problem finding and processes to solve them. Leader 7 recognises this commenting, *"because of the abundance of people and the pace of things, you have to be pragmatic within the world. it's just a recognition that mistakes will happen. "*

Adopting the notion that leadership is a problem-solving endeavour might provide a novel lens through which to look at the role of leader. Through this lens, the leader can leverage the personalities, approaches and creativity of the MDT to problem-solve together, blending their skills and expertise to find novel innovative solutions, breaking the MDT out of its process

orientation and asking them to think differently about the problem. When harnessed and fostered correctly through good leadership, MDTs can provide a competitive edge for the team.

Limitations

This study offers novel insight into the perspectives of leaders on how they leverage and maximise the impact of MDTs operating in high performance sport. Our goal was to understand how leaders leverage MDT and problem-solve within their organisation. A reflexive qualitative approach was deemed appropriate as it was pragmatic and gave the researcher the opportunity to generate meaning from multiple leadership interviews and yet, this methodology embraces researcher bias which have impacted interpretation and the results that have been presented. Whilst this study identifies opportunities for a much broader research agenda, future research will be required to challenge or support our findings. Whilst we are confident in the codes, themes and subthemes we created (Braun & Clarke, 2021a) with the sample of leaders we had access to, further work with leaders from different sport, with various experience levels and representation between genders would glean further useful insight. We believe that we have produced an initial offering into how leaders leverage MDTs to deliver impactful outcomes in high performance sporting context addressing a gap in existing literature. Future research should focus specifically on sporting organisations as complex systems and how leaders operate with certainty and good judgement in unpredictable risky circumstances.

5.2.6 Conclusion

Findings from the current study present a comprehensive model of what leaders attend to and how they leverage the expertise of MDTs. The models could be utilised by sporting organisations, aspiring leaders and leaders of MDTs to maximise MDT impact through effective leadership. Findings highlight that effective leadership in this context is multifaceted. Leaders must navigate two critical domains: the context domain, which involves managing uncertainty, performance problem-solving, and exercising good judgment; and the people domain, which includes fostering professional intimacy, cultivating supportive environments, and setting the right climate. Importantly, there is a necessity for leaders to be at ease within complex, unpredictable systems. They must exhibit confident judgment and resilience in the face of uncertainty, qualities that are non-negotiable in high-stakes sports environments. Consequently, successful leaders rely on experience, intuition, good judgement and prioritise robust teamwork, as evidenced by the people-focused domain of leadership. The essence of problem-solving in high-performance sports leadership is about driving performance through the strategic utilisation of team capabilities. Leaders who can harness the diverse expertise within their teams may transform complexity into clarity and lead their organisations to greater success.

5.2.7 So What

- The qualities of the leaders that participated in this study were confident judgement balancing intuition with data and insights, resilience, adaptability (See the summary infographic in Figure 15).
- Leaders in high-performance sport must achieve success and drive performance whilst contending with complexity.
- Leaders must be able to operate in VUCA environments managing 'wicked' problems and therefore must be comfortable dealing with uncertainty and risk.

5.3 Practical Considerations

- Leaders must navigate structural, systemic, and interpersonal complexity, through which 'VUCA' wicked problems emerge. Developing adaptive thinking and scenario planning skills will help leaders respond flexibly and make informed decisions under uncertainty.
- Wicked and VUCA problems require leaders to 'satisfice' rather than optimise solutions. Leaders should be comfortable making decisions with incomplete information, using intuition and heuristics to guide timely and effective actions.
- Leaders should cultivate trust, clear communication, and shared purpose within MDTs. By fostering psychological safety and setting transparent expectations, leaders enable effective collaboration and high-impact team performance.

5.4 Summary Infographic (Study 3)

Study 3: How Do Leaders Maximise Multi-Disciplinary Team Impact in Elite Sport: Confidence over Uncertainty and Bringing Clarity to Chaos.

Key Findings 8 semi-structured interviews with leaders from high-performance elite sport analysed using a qualitative thematic approach

Two critical domains of leadership

People Domain
Professional Intimacy

| Trust & relationships | Understanding & valuing | Empowerment & support |

Fostering high-performance environments

| Clarity & alignment | Model & enable behaviours | Create space & time |

Setting Climates

| Psychological safety | Collaboration & communication | Sharing & exchange |

Context Domain
Navigating Complexity

| Structures & systems | Reactive & adaptable | It depends & shades of grey |

Good Judgement

| Certainty & risk | Experience & intuition | Information & analysis |

Performance Problem-solving

| Cognitive diversity | Reimagining performance | Plan-do-review |

The high-performance leader

Leadership qualities

Confident judgement

Resilience   Adaptability

Balance intuition & data

Complexity into clarity

Leveraging team expertise

Achieving success

Driving performance

Wicked & VUCA Problems
Volatile, Uncertain, Complex, Ambiguous

Comfort with uncertainty

Able to operate in VUCA environments

Practical Applications:

Foster Team Collaboration

Encourage professional intimacy, supportive environments, valuing team expertise

Embrace Complexity & Innovation

Culture of innovation, continuous exploration, adaptability

Develop Leadership Skills

Leadership development, decision-making, problem-solving, resilience

Decision-Making Processes

Structured frameworks, consultation, transparency, balance of data and intuition

Manage VUCA Environments

Training for uncertainty, managing risks, developing strategies

Leaders must deal with system, structural and inter-personal **complexity** and therefor in elite high-performance sport **problems** are wicked. To enable **performance**, leaders attend to an inter-connected **people** and **context** domain to maximise the **impact** of MDTs. Leaders have to operate in risky, complex & unpredictable systems. Balancing risk with certainty relies on good judgement.

Figure 15: Summary Infographic of Study 3.

Chapter 6: Summary of findings from the body of research

6.1 Overview

The body of work presented in this thesis aimed to establish what performance problem-solving is in high-performance sporting contexts and explore how MDT practitioners go about this. The first objectives were to determine whether practitioners face familiar 'well-defined' problems offering readymade solutions through routines, processes and checklists or alternatively, do they attend to ill-defined unfamiliar problems that require innovative novel solutions. To answer this question, problem-solving types were identified from decision-making and problem-solving approaches. It transpired through the results of Study 1 presented in Chapter 3 (King et al., 2024a) that practitioners report working with simple problems delivering solutions through intuitive expertise however, this was not equivocal and in fact, practitioners also contend with complex ill-defined problems that require rationalising and creativity to solve.

The overarching conclusion from Study 1 (King et al., 2024a) suggests that practitioners require cognitive flexibility, toggling between different problem types, approaches and decision-making styles. It was noted that when considering this finding through the lens of a practitioner within their professional discipline and defined through their scope of practice, does not necessarily align with how practitioners are required to deliver a service as part of a broader inter-professional team, and this merited further exploration.

The second study of the thesis presented in Chapter 4 (King et al., 2024b) therefore explored what MDT practitioners think about and how they operate as part of MDTs assuming that problem-solving and collaboration is a key element of their work. Four 'lubricants' to effective MDT working were identified (see Figure 11). These included, role clarity and shared understanding, adaptability and contextual awareness, diversity of skills, perspectives and ways of working and psychological safety and positive team dynamics. Of interest in the findings was the challenges that practitioners experience when working within MDTs, suggesting a darker reality to their work. It became clear that the term problem-solving (Pitt et al., 2020) (a frequently used term), is an abstract concept that wasn't particularly well explained, and that collaboration and sharing were problematic or problems (by themselves) to overcome (King et al., 2024b).

Practitioners as part of Study 2 (King et al., 2024b) looked to leadership to provide role clarity and to create positive team dynamics through which the MDT could deliver their work. Alongside this, leadership played an important role in directing the team's efforts to attend to the correct problems (King et al., 2024b). A question that arose from Study 2 considered how organisational structures and leaders integrate the defined work processes of disparate professional and coaching disciplines and do these covertly drive some of the ill-defined wicked problems that elite and high-performance practitioners wrestle with. This led to a need to further explore the role of the leader in leveraging the problem-solving capability of MDTs in sport in Study 3 (King et al., 2025).

In the third study, summarised in Chapter 5 (King et al., 2025), the views and perspectives of high-performance leaders who oversee MDTs was sought. Again, problem-solving and decision-making was explored to understand how they leverage the capability of teams within high-performance environments. The key findings noted that leaders contend with system,

structural and interpersonal complexity that creates wicked problems (King et al., 2025). Although not explicit, to overcome these problems leaders work through a people domain creating environments, setting climates and developing relationships within and across the MDT (the how) and a context domain, where leaders use judgement, problem-solving and navigating complexity to make sense of what needs to be done (the what). When asked, leaders struggled to explain and differentiate between problem-solving and decision-making and how they purposefully leverage the skills of the team to complex problem-solving tasks.

This suggests that in some cases mono or multi-disciplinary approaches are more commonplace than some might think with leaders relying on process/routines situated within disciplines rather than integrated inter-disciplinary problem-solving methods. A key finding in Study 3 (King et al., 2025) was that leaders didn't place much importance on terms associated with MDT working suggesting an apparent separation between the body of research that advocates for the merits of different cross-disciplinary approaches with how practitioners and teams operating in practice are organised, structured and led. The current body of work presented in this thesis, in generating an approach to thinking about problem-solving attempts to give greater clarity and purpose to the role of integrated and collaborative MDTs and how organisations and leaders can leverage cognitively diverse teams to create better solutions. Therefore, the following section provides an overview of each study, summarising the innovation and novel findings alongside practical implications and recommendations for practice.

6.2 Chapter 3 (Study 1): Practitioner Lens on Performance Problem-Solving (King et al., 2024a).

Research Question:

Are MDT High-Performance practitioners skilled 'doers' or novel problem-solvers?

Purpose:

This thesis aims to understand problem-solving within high-performance sporting contexts. The initial study explores individual practitioners' perceptions of how they approach their work, specifically in relation to problem-solving and decision-making. Since practitioners work as part of multidisciplinary teams (MDTs), this study offers valuable insight into how individuals report approaching their work in isolation.

Objectives of Study 1:

1. Identify cognitive approaches that are applied by practitioners to delivering their work
2. Identify problem types, problem-solving and decision-making approaches applied by practitioners in their work
3. Identify methods and approaches of work that are applied by individual practitioners

Executive Summary

Refer to the introduction in <u>Chapter 3</u> for a more in-depth review of relevant literature. This study draws on the concepts of thinking, fast and slow (Kahneman, 2011), intuitive expertise (Kahneman & Klein, 2009), and categorising problem types (Alford & Head, 2017; Edmondson, 2012; Schraw et al., 1995) to explore the different approaches practitioners take in delivering their work. This study attempted to bridge the gap between the meta-cognitive strategies deployed by practitioners in their applied practice to glean insight into the different approaches they take to delivering service in their contexts. The purpose of this study was to detangle problem-solving from decision-making to identify whether it shone a light on preferential strategies deployed by practitioners in their practice. There is little research exploring the meta-cognitive and critical thinking skills (Alfano et al., 2019) required and utilised by performance support (MDT) practitioners that work in high-performance settings. Consequently, the findings of this study provided novel insights and have opened new ways of thinking about how practitioners work.

Key Findings:

1. Practitioners that work in high performance sport report attending to simple problems, following processes, routines and checklists through intuitive expertise whilst making 'non' and 'semi' deliberative (fast) decisions.
2. Practitioners report working with complex problems, applying logic and rational to find novel solutions through deliberative decisions.
3. Practitioners require cognitive flexibility and the ability to toggle between different problems providing different approaches and applying different decision styles.

Practical Implications and Recommendations for Practitioners:

- Practitioners would benefit from developing the ability to recognise that different problems, whether well-defined or ill-defined, require different approaches and solutions, and from being purposeful and critical in their problem-solving methods.
- Practitioners would benefit from developing their intuitive expertise. Learning on the job through applied practice with a mentor helping them to see patterns/triggers/cues and anticipate what to do (based on empirical evidence) would be advantageous.
- Scenario and problem-based learning tasks where practitioners are presented with situational problems will also help practitioners to draw on array of 'ready-made' solutions to pre anticipated problems.
- Finally, deliberate reflective practice (a meta-cognitive skill) can enhance practitioners' problem-solving and decision-making capabilities by encouraging purposeful reflection on the critical thinking skills they have applied to a given context. This, in turn, will strengthen their intuitive expertise.

Future Research Considerations from Chapter 3 (Study 1):

- Future research exploring how practitioners differentiate between process-driven approaches (protocols, checklists) and the need to solve ill-defined problems could highlight the misalignment between the 'messy' coaching process and the more 'clean-cut' methods emphasised in professional training.
- Further clarification is needed regarding the types of problems practitioners address in their work and how they distinguish between them. Are the challenges primarily technical (within their discipline) or inter-personal and cross-disciplinary (integration, collaboration, and alignment of processes)? A clearer distinction between MDT problem-solving and discipline-specific problem-solving could better inform the systems, structures, and coordination of various disciplines.
- Tracking practitioners' workflows, processes, and routines, along with the actual work they deliver, could offer insights into the critical meta-cognitive and critical thinking skills needed for effectiveness. Analysing their working practices over time could help identify the essential skills required.

An important question, after establishing that practitioners work with both well- and ill-defined (complex) problems, is how they collaborate within an MDT to solve complex problems. This was further explored in the second study presented in Chapter 4.

Novel Outputs of Chapter 3 (Study 1)

Several outputs were considered novel from publication 1 and contributed to the current body of evidence (King et al., 2024a). Firstly, experience is critical to the success of a practitioner because recognition primed decision making, mental simulation (both critical to intuitive expertise) is developed through experience (Kahneman & Klein, 2009). Furthermore, findings report that that practitioners that work in high performance sporting contexts utilise this approach and therefore open further avenues both for research and for enhanced training opportunities. Whilst there is evidence from different industries, medical and health care specifically (Reale et al., 2023), of an attempt to explore these concepts, sports science and sports psychology have not yet fully reached into this space. Consequently, King et al. (2024a) was highly innovative and novel.

The study attempted to emphasise critical thinking and meta-cognitive skills required by MDT Practitioner working in high performance-sport. By detangling problem types from problem-solving and decision-making approaches and displaying the results on continuums through aggregated heat map visualisations, it has been possible to shed light on practitioner expertise and the cognition that forms the foundations of their approach. To the authors knowledge in a sporting context this has not been explored. Findings from this study enabled us to underpin and illuminate some of the language that is frequently used within sporting contexts with a much greater depth of consideration to what it means and its purpose than has previously existed.

If the findings were further supported through additional research, Professional Judgement and Decision Making (PJDM) (Martindale & Collins, 2013) paradigm becomes a key component of the requirement of MDT practitioners enabling them to navigate the requirements of their roles. PJDM as a concept has been explored with both sports' psychology (Martindale &

Collins, 2013) and S&C practitioners (Till et al., 2020) as well as coaches (Collins & Collins, 2015). This paper both supports and underpins the case for further socialising the case for intuitive expertise and PJDM. There is a disconnection between empirical, evidence led methods of training practitioners for a discipline and how they might have to operate (skills, knowledge and expertise) to be effective within the MDT – this is explored further in Study 2.

Summary of novel outputs from Chapter 3 (Study 1) (King et al., 2024a)

Practitioners must work with both simple 'well-defined' and complex 'ill-defined' problems.

1. Practitioners are both intuitive experts whilst being required to be problem-solvers.
2. In part, practitioners deliver through routines, schedules and checklists delivering through processes. This somewhat automated repetitive style of working does not lend itself to complex problem-solving.

6.3 Chapter 4 (Study 2): MDT Lens on Performance Problem-Solving (King et al., 2024b).

Research Question:

What do practitioners do and how do they operate as part of MDT in high performance sport?

Purpose:

This thesis' overarching aim was to understand problem-solving within high-performance sport contexts. Initially, Study 1 explored the strength of individual practitioners' perceptions regarding problem-solving and decision-making. Building on the finding that practitioners report working with complex problems through routines, checklists and protocols, the second study seeks to establish the attitudes of MDT practitioners toward collaboration within multidisciplinary teams, as well as their perspectives on problem-solving and decision-making in this context. Understanding how practitioners operate and what they do as part of an MDT should further illuminate the need for collaboration to enhance problem-solving capability in sport.

Objectives of Study 2:

1. Identify barriers and facilitators to effective MDT working
2. Understand the experiences of operating as part of an MDT by practitioners
3. Explore the experiences of practitioners in collaboration, problem-solving and decision-making when working as part of an MDT

Executive Summary:

Chapter 4 highlights that MDTs are commonplace in many industries including high-performance sport. Whilst there is a growing body of literature advocating the use of MDTs, IDTs, TDTs and DoMs (Alfano & Collins, 2021; Burns & Collins, 2023; Reid et al., 2004; Rothwell et al., 2020; Salcinovic et al., 2022; Stewart et al., 2024a; Vaughan et al., 2019; Woods et al., 2021) there is in fact a limited body of evidence exploring what MDT practitioners attend to and how they operate as a team in high performance sporting contexts (Stewart et al., 2024a). Through the lens of practitioners operating as part of an MDT and how they think about problem-solving, the literature is even sparser. It is known that cognitively diverse teams can outperform individual talent when problems are complex (Hong & Page, 2004; Page, 2019) and yet, this well explored body of literature has not been socialised into the world of elite sport. It seems that although the recognition of the value of providing a cross disciplinary approach, our ability to rationalise and justify this in how we go about purposefully leveraging diversity is relatively untapped. Chapter 4 makes some simple assumptions supported through literature that underpin the merits of cross disciplinary working. Through these assumptions the study enabled an exploration of the views and perspectives of MDT practitioners on themes relating to collaboration, sharing, problem-solving and decision-making.

Key Findings:

1. A thematic map and four themes were identified depicting what and how MDTs operate.
2. The four domain topics (the 'what') were (1) Decision Making & Problem Solving; (2) Collaboration & Knowledge Sharing; (3) Interpersonal Skills & Development and (4), Leadership & Team Dynamics.
3. The four themes for how practitioners operate (the lubricants of successful MDT working) were (1), Cognitive diversity is important however not if it slows us down, (2) Staying in your lane is encouraged however sharing and collaboration is important (3), We need psychological safety, however poor behaviour keeps getting in the way and (4), High confidence in a world of nuance and uncertainty; adaptability and context is key.
4. The thematic map presents an idealised perspective of how practitioners' function within MDTs in high-performance sport. Figure 11 (Chapter 4, p.71) could provide a stimulus to develop novel training programmes to enhance practitioners' capability to perform as part of an MDT.
5. This utopian view contrasts with the reality practitioner's face. Their frustrations, challenges, and reflections stemming from failures paint a darker picture of their experiences, highlighting the complexities inherent in their work and flagging considerations for both practitioners and leaders

Practical Implications and recommendations for practitioners and teams:

- Practitioners would benefit from training and support in how to operate as part of an MDT. Supporting practitioners with methods and approaches on how to integrate

practices with colleagues from other disciplines would create clarity from the off as opposed to learning as they go.

- Practitioners interpret sharing as the information that they hold and identify confidentiality as a blocker to fully engaging with this. They reported that they used information judiciously deciding when and what to share that hinted at information as a source of power. (Re) positioning 'sharing' as 'team cognition' and 'shared mental models' was not suggested by the participants in the study and therefore presents an opportunity to reframe what sharing is and move teams beyond using information as a currency.
- Mobilising practitioners around problems to be solved might enable them to circumnavigate some of the inter-personal, political and professional barriers that were highlighted and clearly exist in MDTS in high performance sport.
- Practitioners were not confident in differentiating between decision-making and problem-solving nor did they have a strong sense of clarity of what these were in professional practice. Effort must be made to overtly and explicitly link the nested critical thinking skills that practitioners develop in education/training to applied practice.
- Finally, positive team dynamics, effective leadership, role clarity and psychological safety were all identified as very important to the effectiveness of MDTs. Each of these requirements point to *leadership* as critical in the successful integration of MDTs. Study 3 sought to understand the perspective of high-performance leaders in mobilising MDTs to problem-solving.

Future Research Considerations from Chapter 4 (Study 2):

- Observing mature, well-formed and experienced MDTs operating in the field as a team would provide significant insights into their methods and approaches. Gaining greater clarity on whether collaboration between practitioners in teams to solve problems is required.
- Researching concepts such as team cognition and shared mental models would be advantageous at an operational service delivery level, in making sense of how the MDT align with a sport and the coaching process and rationalise what and how they deliver.
- Greater attention should be given to integrating cross-disciplinary expertise. Practitioners should be equipped with interpersonal and critical thinking skills for effective collaborative problem-solving, alongside their discipline-specific training. This would enable professionals, often trained in silos, to leverage and blend their expertise and tools with those of other disciplines.

Practitioners acknowledge the importance of effective leadership and fostering positive team dynamics to fully leverage the benefits of multidisciplinary teams. A deeper understanding of the attitudes and perspectives of leaders who manage MDTs, as well as how they utilise these teams to enhance problem-solving capabilities, warrants further exploration. This question is addressed in Study 3.

Lubricants that support effective MDT working in high performance sport were identified in Study 2 (King et al., 2024). The investigation was able to illustrate that although there is a net benefit to providing MDT support within sporting contexts, there were also some disadvantages. The thematic analysis demonstrates the importance of interpersonal skills,

collaboration and sharing, decision-making and problem-solving, as well as leadership and positive team dynamics in delivering effective MDT support. Alternatively, it became evident that MDT practitioners grapple with what and when to share with colleagues. They believe that collaboration and MDT working can slow down progress, and they often struggle to work effectively with practitioners from other disciplines, both personally and professionally (King et al., 2024b). Additionally, there is an acknowledgment from the findings in Study 2 (King et al., 2024b) that problem-solving is often ambiguous and decision-making is complex owing to the uncertainty practitioners contend with. Through this investigation, a model (See Figure 11; p.71) for MDT practice in high-performance sport has been created. This model serves as a guide for developing the critical competencies and skills that practitioners require to be effective in their practice.

Summary of novel outputs from Chapter 4 Study 2 (King et al., 2024b) :

1. MDT practitioners often find it challenging to define what problem-solving entails and to determine how, or if, they should engage in problem-solving as part of a cross-disciplinary team.
2. Practitioners must navigate inter-personal conflict that stifles the ability of the team to openly collaborate and share.
3. From the sample of practitioners that participated in this study, it is possible to conclude that providing training (process, approaches and methods) to individual and team problem-solving would be highly advantageous and impactful on team performance.

6.4 Chapter 5 (Study 3): Leadership and Organisational Lens on Performance Problem-Solving (King et al., 2025) (King et al., 2025).

Research Question:

How leaders maximise the impact of MDT in high-performance sport and what do they do?

Purpose:

This thesis aims to explore problem-solving within high-performance sport contexts. Initially, it established that practitioners navigate both simple and complex problems, concluding that they must exhibit cognitive flexibility by toggling between various problem types and approaches. While practitioners acknowledge the value of collaborating within multidisciplinary teams, the second study reveals a range of challenges that hinder team progress. One significant challenge identified is the need for effective leadership and the cultivation of positive team dynamics to facilitate collaboration. To deepen our understanding of problem-solving in high-performance sports, Study 3 emphasised the importance of examining the views and perspectives of leaders regarding MDT collaboration and problem-solving, as this insight can enhance our comprehension of problem-solving capabilities in high-performance sporting contexts.

Objectives of Study 3:

1. Identify leader's perspectives and views of MDTs in sport
2. Identify how leaders of MDTs operate and what they do to maximise the value and leverage the expertise and capabilities of the MDT

Executive Summary

There is a body of literature on leadership with an almost infinite number of models and approaches 'of' leadership being championed (Arnold et al., 2019; Arnold et al., 2018; Arnold et al., 2012; Fletcher & Arnold, 2011, 2015; Salcinovic et al., 2022; Sharma & Jain, 2013; Stewart et al., 2024b). Despite this, there is a significant dearth of research investigating leadership of MDTs in high performance sporting contexts (Alfano & Collins, 2021; Jowett, 2024). In Chapter 5 with the support of literature, the case was made that leaders working in high-performance sporting contexts must contend with inter-personal, system and structural complexity (King et al., 2025). There is an implicit recognition that problem-solving is a requirement of sporting organisations and leaders and yet, the explicit overt link between leadership and the purposeful integration and alignment of cognitively diverse teams to attend to (and solve) problems in high performance sporting contexts is missing. A gap in our existing knowledge base reflects the need for further exploration through investigation as to what leaders do and how they operate to deliver impactful outcomes from the MDTs in the elite and high-performance sporting organisations they lead (Jowett, 2024). In exploring the views, beliefs and perspectives of current leaders that work in sport in Study 3 (King et al., 2025), it was possible to extend our understanding of whether practitioners and teams do indeed need to problem-solve and build a model 'for' leaders operating in sport that support their ability to leverage the problem-solving capability of teams.

Key Findings:

1. Leaders that work in high-performance sporting contexts contend with inter-personal, structural and system complexity.
2. When asked about their understanding of MDTs and how they utilise them, leaders had mixed views. They highlighted both benefits and drawbacks of the term "MDT" and preferred to describe MDT practice simply as good teamwork.
3. Leaders leverage the MDT by attending to a people domain comprising of professional intimacy, setting the environment and fostering climates and a context domain made up of performance problem-solving, navigating complexity and good judgement.
4. Leaders did not appear to be able to clearly discriminate between decision-making and problem-solving and did not appear to have clear processes that they deployed in either domain.
5. Problems appear to be both ill and well defined with leaders attending to the obvious overt problems.
6. Ill-defined problems emerge from structures, systems and people that leaders must contend with.

Practical Implications and Recommendations for Leaders and Organisations:

- A thematic map (see Figure 13) was developed for use by current and aspiring leaders/sporting organisations to better leverage the problem-solving capability of MDTs.
- Leaders must recognise that problems can be systemic, structural or inter-personal. Such problems often create poorly defined problems, which add to system complexity and can become challenges across the entire organisation.
- Enforcing an MDT integrated approach and collaboration (such as a mixologist) could create complexity, increase ambiguity and reduce problem-solving capability. Supporting mono-disciplinary working with better cooperation between disciplines (such as orchestrator) will reduce elements of complexity.
- Applying concepts from complexity theory such as inter-dependence, coupling, de-coupling and system slack to the workflows, processes and approaches to MDT working could be highly advantageous in identifying and confidently resolving certain types of problems.
- Utilising the MDT for complex problems through special projects, and doing so more selectively, helps in defining the problem and applying purposeful processes (such as design thinking) to solve them. This approach further supports practitioners in using appropriate critical thinking skills within these processes.
- A more challenging solution to increasing MDT problem-solving capacity would be to adopt a horizontally integrated (cross discipline) over a vertical integration (by discipline) organisational structure. This would have implications for how a practitioner operates, what team they identify most closely with and how their expertise and knowledge develop and integrates (cross pollinates) with other disciplines.

Future Research Considerations from Chapter 5 (Study 3):

- Research investigating high-performance sporting organisations as complex systems could open avenues to better connect concepts from complexity theory to problem-solving and decision-making across practitioners, teams and leadership.
- There is extensive body of literature on leadership models (of leadership). Further work needs to be conducted with leaders in sport to better understand what they attend to and why (for leadership) when attending to problem-solving capability within an organisation. There is an opportunity to build on the findings of this thesis in this area.
- Despite problem-solving being a widely accepted requirement of practitioners and teams in sport, the term is abstract and the task of problem-solving does not have definition. The requirement for problem-solving capability by MDTs is in sport requires further investigation in how to better align individuals and teams to effectively attend to them.
- Research exploring how leaders can cultivate and foster team cognition, shared mental models and shared expertise through the horizontal integration of different disciplines would provide a fascinating new way of exploring problem-solving capability in high-performance sport.

Novel outputs of Chapter 5 (Study 3):

A thematic map and model 'for' leadership in high-performance sport was created out of the findings from Study 3 presented in Chapter 5 (King et al., 2025). This can be used by organisations, leaders and teams to assess their environments, their approach and how they operate to effectively deliver problem-solving within their context. Alongside this, the study creates a strong argument for the merits of complexity theory as a useful lens for understanding how the ill-defined, complex problems that exist across sporting organisations and within teams emerge. Through this interesting mesh (critical-thinking, inter-personal skills and complexity), a new vocabulary can be used to underpin problem-solving capability in high-performance sport.

Summary of novel outputs from Chapter 5 (Study 3) (King et al., 2025):

1. Problems can be obvious, overt, and explicit, these are typically operational issues that leaders, teams, and practitioners intentionally address.
2. Problems can be ambiguous, covert, or implicit, often structural, systemic, or interpersonal. These exist within the complex systems of high-performance sporting organisations.
3. Leaders can benefit by leveraging the critical thinking capabilities of practitioners and teams through intentional processes. Additionally, they might consider systemic interventions (e.g., team organisation or promoting mono- and multi-disciplinary approaches) to reduce complexity by decoupling or creating slack between cross-disciplinary work processes.

Chapter 7: Practical Perspectives and Considerations developed from the body of research.

7.1 Overview

The primary aim of this chapter is to present the impactful considerations that have emerged from the body of research that have implications for practitioners, teams, and leaders operating within MDT contexts in sport. It considers and presents three key perspectives that are grounded through the three studies and supporting contemporary literature:

- **Practical Perspective 1**: Defining Problem-Solving and Collaboration in High-Performance Sport
- **Practical Perspective 2**: Enhancing Problem-Solving in High-Performance Sports: The Critical Role of Horizontal Skills
- **Practical Perspective 3**: Design Thinking as a Method to Enhance Problem-solving Capability of MDTs

Firstly, Section 7.2 examines from the findings in Chapter 3 (King et al., 2024a) whether problem-solving and collaboration are relevant and necessary in high-performance sports environments. Section 7.3 draws on the findings from Chapters 4 and 5 (King et al., 2024b; King et al., 2025), by further exploring the skills required for effective problem-solving within an MDT through the introduction of the T-Shaped practitioner concept. Finally, critiquing further the discussion in Chapter 3 where cognitive flexibility is introduced and the need for practitioners to toggle between different approaches (King et al., 2024a). In Section 7.4, the concept and investigation behind how design thinking can contribute to high-performance sport is expressed before finally suggesting in an example framework for utilising the diversity within teams through a structured processes are presented.

7.2 Practical Perspective 1: Defining Problem-Solving and Collaboration in High-Performance Sport

Problem-Solving in Teams

The term problem-solving is often used in high performance sport settings. It is both a tacit requirement and implicit in high performance sporting contexts that practitioner's problem-solve and require problem-solving skills both as individuals and through the MDT. Within the literature authors often refer to problem-solving when discussing teamwork (Nancarrow et al., 2013), multi-disciplinary and interdisciplinary (Burns & Collins, 2023) team approaches. Vaughan et al. (2019) argue that sport is a transdisciplinary wicked problem which involves integrating knowledge and methods from multiple disciplines to find creative solutions. Rothwell et al. (2020) argue that it is challenging to integrate sub-disciplines to enhance performance preparation, and that this problem of integration is embedded in the reductionist method of applied sports science. Rothwell et al. (2020) suggests departments of methodologies as unifying concept to coordinate activity, communicate ideas and collaboratively design practices. It appears that in applied practice, practitioners and teams

are expected to problem-solve. The findings from the body of this thesis suggests that teams often do so without explicitly discussing their approach to problem-solving or even the problems they address (King et al., 2024a; King et al., 2024b; King et al., 2025). Furthermore, it highlights that inter-professional team working can present a significant problem to overcome.

Problem-Solving Practitioners

In the results presented in Chapter 3 (Publication 1), the strengths of MDT practitioners in their applied practice, focusing on how they perceive and approach their work. A 71-item Likert scale survey was developed to better understand the challenges practitioners face, as well as their problem-solving and decision-making strategies in practice. Findings from this study indicated that practitioners encounter simple and complex problems, employing a range of problem-solving and decision-making approaches in their work (King et al., 2024a).

Figure 5, presented in Chapter 3 (p39), illustrates how practitioners approach their work, as rated through the Likert scales. This hierarchical framework begins with the type of problem being addressed, followed by the chosen problem-solving approach, and finally, the decision-making style. Consequently, Figure 16 provides a concise summary of the continuums developed in Chapter 3 (Publication 1), reflecting the varied approaches practitioners use (King et al., 2024a). The framework provides a straightforward reference for practitioners, helping them to evaluate their own methods while underscoring the critical observation that they navigate both simple and complex problems in their roles.

Problem Solving Type (PST)

Tame/Simple ●————————————● **Wicked/Complex**

These are problems where solutions are clear and well-defined, often with established methods or routines for addressing them. The challenges are predictable and manageable through systematic procedures. The environment is stable, and tasks are repetitive or routine, relying heavily on established processes and expertise.

These involve issues that are ambiguous and multifaceted, often lacking clear solutions. The nature of these problems is dynamic and evolving, requiring innovative and adaptive approaches. Solutions are not straightforward and may involve complex interactions and uncertainties. Such problems often require creative thinking and flexible strategies.

Problem Solving Approach (PSA)

Procedural ●————————————● **Creative**

This approach involves following established methods, procedures, or protocols to address problems. It is characterised by reliance on systematic processes, routine tasks, and structured approaches. The focus is on applying known techniques and guidelines to achieve solutions efficiently and consistently.

This approach emphasises innovation, experimentation, and exploration of new ideas or methods. It involves thinking outside traditional frameworks and applying novel or unconventional solutions to challenges. Creative problem solving values adaptability and originality in addressing complex or unique issues.

Decision Making Approach (DMA)

Fast ●————————————● **Slow**

This approach relies on quick judgments based on experience, intuition, or gut feeling, sometimes referred to as intuitive expertise. Decisions are made rapidly without extensive analysis or deliberation. It often involves relying on heuristics or instinctive responses to address immediate needs or uncertainties.

This approach involves a deliberate and methodical process for making decisions. It emphasises thorough analysis, data evaluation, and logical reasoning before reaching conclusions. Decisions are made after careful consideration of various factors and potential outcomes, often involving extensive information and structured evaluation.

Figure 16: A framework for establishing problem-solving type, problem-solving approach and decision-making[11]

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[11] Figure 16 is adapted from King, McHugh, et al., (2024) the framework highlights three possible continuums on which practitioners can differentiate their approaches and processes to the type of work required.

Practitioners deliver services within their specific disciplines and collaborate as part of cross-disciplinary teams where teamwork is essential (Burns & Collins, 2023). That said, there may be a disconnection between the procedural, checklist-driven approaches traditionally associated with empirically led 'evidence-based' practices by practitioners within their disciplines (King et al., 2024a) and the collaborative, problem-solving methods required for effective performance in MDTs (King et al., 2024b). This highlights the importance of balancing structured routines with adaptive collaboration to meet the demands of day-to-day practice in performance support teams.

Complex and Wicked Problems

Alford and Head (2017) argue that as problems increase in complexity, from well-defined to ambiguous, and as more stakeholders and institutions become involved (shifting from cooperative relationships to interactions between parties with conflicting values and interests), the nature of these problems changes. Problems evolve along a continuum from being categorised as tame to complex and, ultimately, to very wicked (Figure 17) (Alford and Head., 2017).
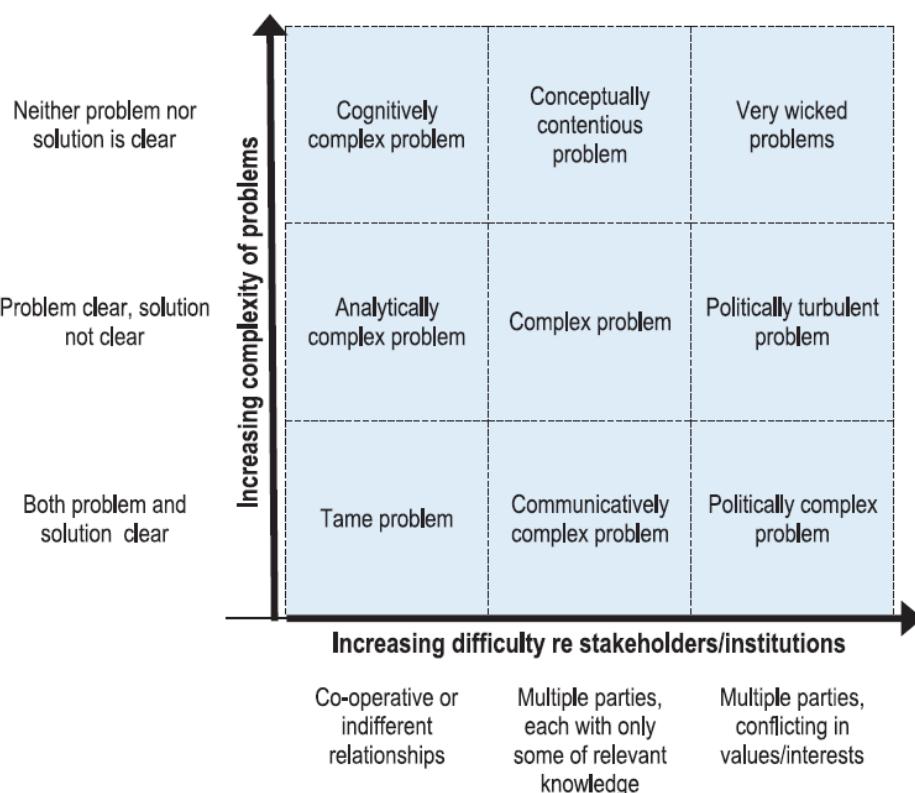
Figure 17: Alternative Types of Problems (Alford & Head, 2017)[12]

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[12] A framework to explore the two-dimensional matrix of problem possibilities. Reprinted from "Wicked and less wicked problems: a typology and a contingency framework," by Alford, J. and Head, W., (2017), Policy and Society, Volume (36)3, p 402.

When considering Figure 17 (Alford & Head, 2017) in the context of MDT practitioners working in sport, it appears that the collaborative nature of multidisciplinary teams can itself give rise to 'complex', 'politically complex' and 'wicked' problems. Noting the results from Chapter 3 (Publication 1; (King et al., 2024a)) that practitioners often work with simple problems and when asked to work collaboratively (i.e. multiple parties, conflicting in values and interests), this would give rise to politically complex problems. Cross-disciplinary teams often strive to integrate and coordinate their work in a seamless and aligned manner, yet this very process of collaboration can create challenges especially when problems are tame and solutions are clear. Collins et al. (1999) and Reid et al. (2004) were among the first to question whether MDTs in sport science could result in conflicting objectives. Their work has been highly influential, sparking further research on how support teams in high-performance sport function (Alfano & Collins, 2021; Alfano & Collins, 2023; Stewart et al., 2024a).

In a recent study, Stewart et al. (2024a) identified key factors contributing to team effectiveness, including team structure, individual team member attributes, shared mental models, and social capital. These findings suggest that high-performance sports organisations inherently generate complexity, due to departmental structures and through the need to integrate diverse professional teams in support of coaching programs. These findings were reinforced by both practitioners (King et al., 2024b) and leaders (King et al., 2025) in study 2 and 3 of the thesis adding further weight to the complexity and ambiguity inherent in these environments..

Social capital, comprising elements such as trust and mutual respect, appears to be especially critical for practitioners (Stewart et al., 2024a). This is likely due to the diversity of professional backgrounds within MDTs, which can drive individuals to engage in behaviours such as politicking, infighting, and jockeying for status (King et al., 2024b). Practitioners may perceive that demonstrating their individual value or worth within their discipline enhances their job security, further compounding the complexity of collaboration within these teams.

Complexity and Problem-Solving

In Chapter 5, the results from the investigation revealed that leaders face system, structural, and interpersonal complexity (King et al., 2025). Complexity science (Balague et al., 2013), discussed in Chapter 5 (p84), provides a valuable lens for understanding these challenges in sporting contexts. According to this perspective, complexity arises from the interdependence and coupling of systems. When multiple systems rely on one another, errors and failures become difficult to identify and address (Karwowski, 2012; Weick, 2004). In the context of sporting systems, the integration of practitioners from diverse professional backgrounds and departments is a key objective. To achieve this, work processes must be aligned to deliver a holistic service, with problem-solving as a central expectation. Using Alford and Head (2017) framework (Figure 17), this integration may lead to the emergence of both wicked problems and system complexity. Like wicked problems, system complexity is challenging to navigate, particularly when failures occur or when issues are difficult to diagnose and resolve (King et al., 2025). To mitigate these challenges, strategies such as creating slack, decoupling processes, and building redundancy between systems can help reduce complexity and enhance

resilience (Rijpma, 2019). These approaches simplify problems, making them easier to detect and address. The findings from the investigations carried out for Chapters 4 and 5 (publications 2 and 3 respectively) strongly emphasise that the diversity of skills and collaboration are key advantages of MDT working. Moreover, and collectively these studies highlight significant challenges in ensuring MDT practitioners collaborate effectively as a cohesive team (King et al., 2024b; King et al., 2025). While there is a clear desire to foster collaborative teams, which inevitably increases inter-personal and system complexity (as discussed in Chapter 5), it may be worth considering whether collaboration should be used more selectively. Limiting collaboration to critical areas could reduce system complexity and make these systems more manageable.

Cognitive Diversity and Problem-Solving

The results from Chapter 5 (publication 3) indicate that leaders rely on cognitive diversity and the integration of discipline-specific teams to solve complex problems (King et al., 2025). Leaders often describe these problems as efforts to achieve unprecedented goals, such as reimagining performance or setting new world-best achievements (King et al., 2025). Such ambitious objectives are inherently difficult to accomplish and benefit greatly from the diverse perspectives and expertise of an MDT, rather than relying solely on individual capability.

Leaders further emphasised the importance of Plan-Do-Review cycles and the need to run special projects or pursue innovations (King et al., 2025). These initiatives are often aimed at exploring new opportunities to create a competitive advantage or responding to external changes, such as new rules that impact the speed or duration of gameplay.

These examples provide valuable context for the findings from the publication presented in Chapter 3, which highlighted that practitioners must toggle between addressing simple and complex problems (King et al., 2024a). Findings align with the insights from the published investigation in Chapter 4, where practitioners identified problem-solving as a central component of their work despite taking issue with the term (King et al., 2024b). Together, these discoveries suggest that collaborative MDT working is most crucial in situations requiring creative problem-solving, innovation, and adaptation to complex problems, where the integration of diverse skill sets and perspectives offers significant advantages.

Collaboration, Coordination or Cooperation

If ill-defined, wicked problems are born out of complexity (clarity of the actual problem to be addressed and the number of stakeholders/institutions attending to it), the requirement for true collaboration within the broader team may need to be considered. It seems coordination, cooperation and communication (Salas et al., 2018) (enabling the disciplines to attend to tasks within their scope of practice) might trump collaboration within MDTs.   In this instance, effective communication and alignment of individual discipline goals could well be sufficient. In contrast, collaboration could be leveraged more sparingly when problems are truly complex. In practice, special 'pop up' projects seeking to find innovative solutions and strategies to keep ahead of the competition, finding new levels of performance or challenging traditional sporting dogmas could be a liberating endeavour for the MDT at the right time, in the correct space through supportive structures and processes (see Chapter 7.4) (Joachim et al., 2020). There is

a question of how to identify the problems that are to be explored/solved and when the best time to do this is within busy performance schedules. Enabling practitioners to be creative, innovative and explore how skills and expertise can be applied in novel ways (Santos et al., 2016) might allow sporting organisations to leverage practitioner's knowledge and contribute more broadly to the performance problem-solving requirement. This is an exciting prospect when aligned to solving difficult problems that could have a high impact on performance.

Conclusion

In high performance sporting contexts, we should be more considered in the use of the terms problem-solving and collaboration. Taking time to consider the type of problems that practitioners and teams are attending to and therefore, the types of approaches to solving them would be a particularly useful task to adopt within the planning processes followed in most sporting organisations (Figure 16., p121). It is essential to clarify when coordination and cooperation among practitioner teams within a mono-disciplinary delivery paradigm would be most effective, and when collaboration as part of a MDT approach is more suitable for addressing complex, wicked problems. This would allow for practitioners to apply the use of their practical, technical and cognitive skills to attend to the right problems with the right approaches. Importantly, this type of considered approach to problem-solving in high performance sport might enable leaders and practitioners to transcend some of the system and inter-personal complexity they contend with and reduce the conflict and ambiguity that exists around the realities of collaboration.

Practical considerations and link to the body of work:

In Chapter 3 it was shown that practitioners require cognitive flexibility toggling between simple and complex problems. As part of MDTs, (as shown in Chapter 4., publication 2; (King et al., 2024b)), practitioners recognise the value of diverse skills, perspectives and ways of thinking in problem-solving yet can articulate significant inter-personal and inter-professional challenges operating as part of MDTs. This first perspective argues that leaders and practitioners operating in teams must purposefully discriminate between simple and complex problems through overt processes. This task will help teams to perform the cognitive toggling required to attend to different problems and distinguish between individual and team-based solutions. By discriminating between problem types and approaches, leaders and practitioners can deploy clear tactics on whether they require collaboration to attend to complex problems or effective cooperation and coordination to integrate service around simple 'individual task based' work processes and problems.

Whether cooperation, coordination or collaboration is required, practitioners must be able to effectively work together. The second perspective that follows explores what skills and behaviours are required by practitioners to be effective as part of MDTs given that through the body of this thesis, results have strongly suggested challenges in integrating discipline perspectives to attend to novel problems.

7.3 Practical Perspective 2: Enhancing Problem-Solving in High-Performance Sports: The Critical Role of Horizontal Skills

The second perspective presented in this chapter aims to provide insights into the skills, knowledge, and expertise required by performance and medical practitioners, as derived from the findings in Chapters 4 and 5 (publication 2 and 3 (King et al., 2024b; King et al., 2025)). Practitioners in sport are expected to collaborate effectively and possess strong problem-solving capabilities (Burns & Collins, 2023). However, the evidence derived from the investigations presented in this thesis paints a more complex picture.

As outlined in Chapter 3 (publication 1; King et al., 2024), practitioners encounter diverse challenges and problem types. Chapter 4 (publication 2., (King et al., 2024b)) highlights significant difficulties faced when working within MDTs. Specifically, the findings suggest that leaders play a pivotal role in fostering role clarity and positive team dynamics. This theme is further reinforced in Chapter 5 (publication 3., (King et al., 2025)), where leaders emphasised the importance of focusing on people and the ways they function within a team setting.

A tension emerges between working independently and collaboratively. The results collectively confirm that while technical proficiency is crucial for practitioners to deliver effective solutions within their respective disciplines, collaborative problem-solving as part of a team is equally necessary for addressing complex and novel challenges (King et al., 2024a; King et al., 2024b). It appears that practitioners struggle to balance the application of their individual technical expertise with the demands of collaboration. This tension may contribute to both the findings of Chapter 3 (publication 1., King et al., 2024) and the frustration, challenges, and conflicts observed within MDTs, as evidenced in Chapter 4 (publication 2., (King et al., 2024b)).

Within the industry, technical expertise is highly coveted by practitioners, leaders, and sporting organisations. To better understand the critical skills and behaviours needed for effective MDT collaboration, the studies in Chapters 4 and 5 (King et al., 2024b; King et al., 2025) explored practitioners and leaders perspectives on these essential skills, the value of teamwork, and attitudes toward collaboration, decision-making and problem-solving. The results raised useful insights and raised interesting questions around whether technical skill alone enable effective problem-solving, and if these skills are being successfully applied in collaborative contexts.

The following section explores the balance between the technical and non-technical skills required by MDT practitioners born out of the competing demands placed upon them, based on the exploration and findings in the body of the thesis.

What types of problems do practitioner face?

Results from Chapter 3 (publication 1., (King et al., 2024a)) suggested that practitioners tend to address simple problems through routines, procedural approaches and intuitive expertise however, they additionally contend with complex problems requiring more novel approaches to solving them. This flagged a consideration for how practitioners' toggle between delivery within their discipline versus how they operate within the broader MDT. To build on the

findings of Chapter 3 (publication1., King et al., 2024), in the study presented in Chapter 4 practitioners were asked how they operate as part of MDTs through a focus group methodology, it was clear that inter-personal skills, collaboration and problem-solving were deemed as important requirements and yet significant challenges were raised with this (King et al., 2024b). What was evident in this study (King et al., 2024b) was that while cognitive diversity, defined as individuals with different backgrounds, professional disciplines and ways of thinking (Aggarwal & Woolley, 2019; Mello & Rentsch, 2015) was highly valued, practitioners further sought role clarity, a finding consistent with Stewart et al. (2024a) and psychological safety. Both needs were framed within the challenging reality of working as part of an MDT in high performance sporting contexts.

The collective results presented from the investigations as part of this thesis in Chapter 3 (King et al., 2024a) and Chapter 4 (King et al., 2024b) coupled with the discussion above presents a clear argument to differentiate between problem-solving types and therefore problem-solving approaches by individuals and support teams within high performance sport (Alford & Head, 2017; Edmondson, 2012; Greenberg & Clubb, 2021; Johansen & Euchner, 2013; Kitchner, 1983; Schraw et al., 1995). With complex and wicked problems (i.e. solutions are unclear), cognitively diverse teams have been shown to be better at problem-solving than individuals alone (Hong & Page, 2004; Mello & Rentsch, 2015). In high-performance sport contexts, the findings from Chapters 3 and 4 suggest that practitioners often address complex problems, even while relying on routine and procedural approaches (King et al., 2024a). Additionally, they recognise the benefits of the cognitive diversity within the MDT (King et al., 2024b). Accessing team members cognitive repertoire (Mental Models, Perspectives, Heuristics, Tools) (Page, 2019) to attend to these 'hard to solve' problems require the ability to share knowledge and collaborate. In high performance sporting environments, there is potential for high pressure (Alfano & Collins, 2023), conflict and disagreement, differing views and opinions. Due to this, combining skills and expertise between disciplines and team members may well be hard to realise in practice.

The skills and knowledge required by practitioners

Using unreported data collected and analysed through the methods used in Chapter's 4 and 5, (King et al., 2024b; King et al., 2025) practitioners and leaders working in high performance sport were asked what skills and knowledge were essential for practitioners working as part of MDTs. Practitioners and Leader's responses were analysed using reflexive thematic analysis (Braun & Clarke, 2006) and thematic maps were created to illustrate themes and sub themes (Figure's 18, 19 & 20). Whilst all groups of practitioners and each leader that took part in the research acknowledged that technical skills were a requirement of the role, surprisingly much more credence and importance were placed on non-technical and soft skills. Practitioners and leaders that work in high-performance sport contexts all acknowledged that to work as part of MDTs, practitioners need meta-cognitive (Figure 18), inter-personal (Figure 19) and critical thinking (Figure 20) skills (King et al., 2024b; King et al., 2025).
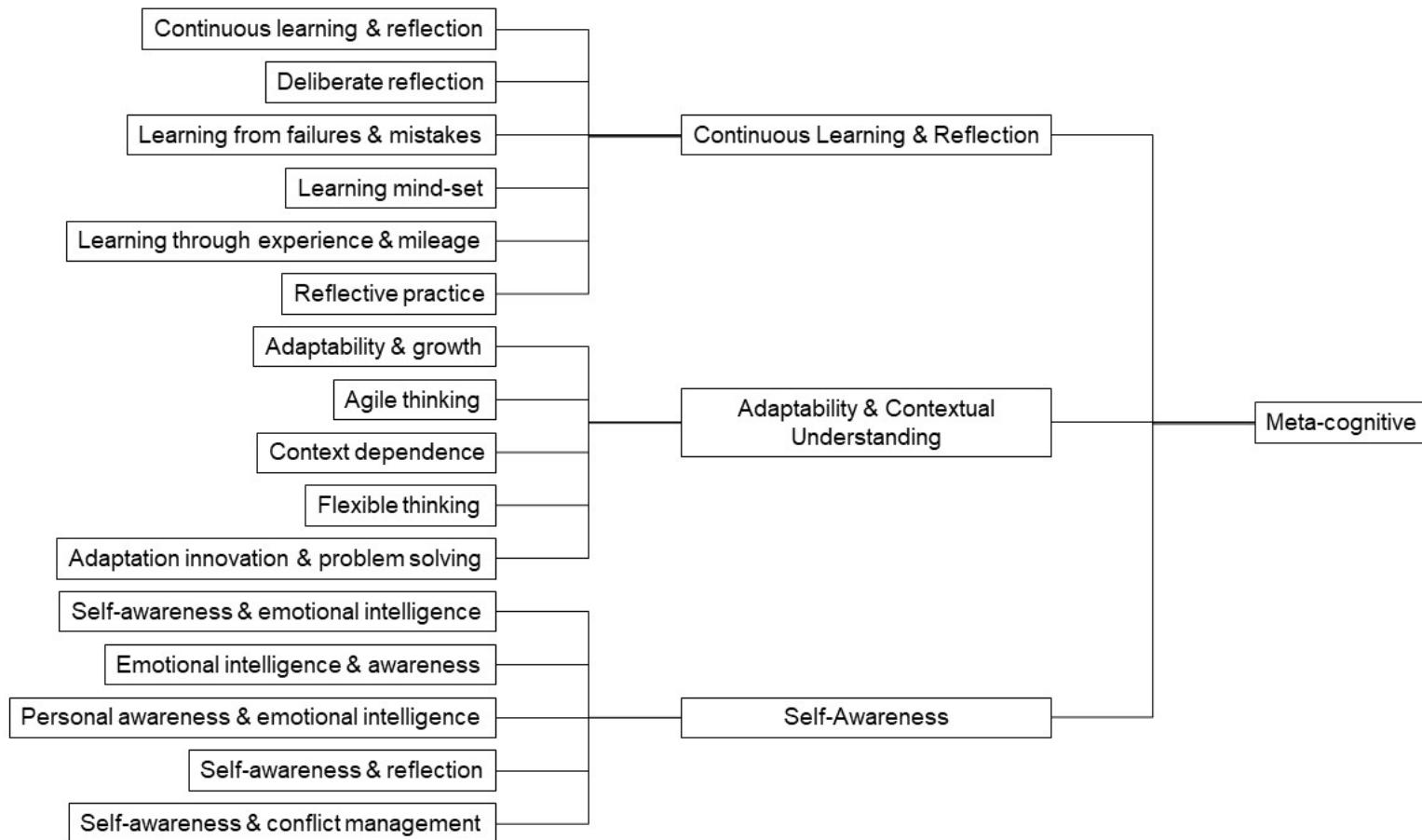
Figure 18: Meta-cognitive skills identified by Practitioners and Leaders as important to effective MDT working.
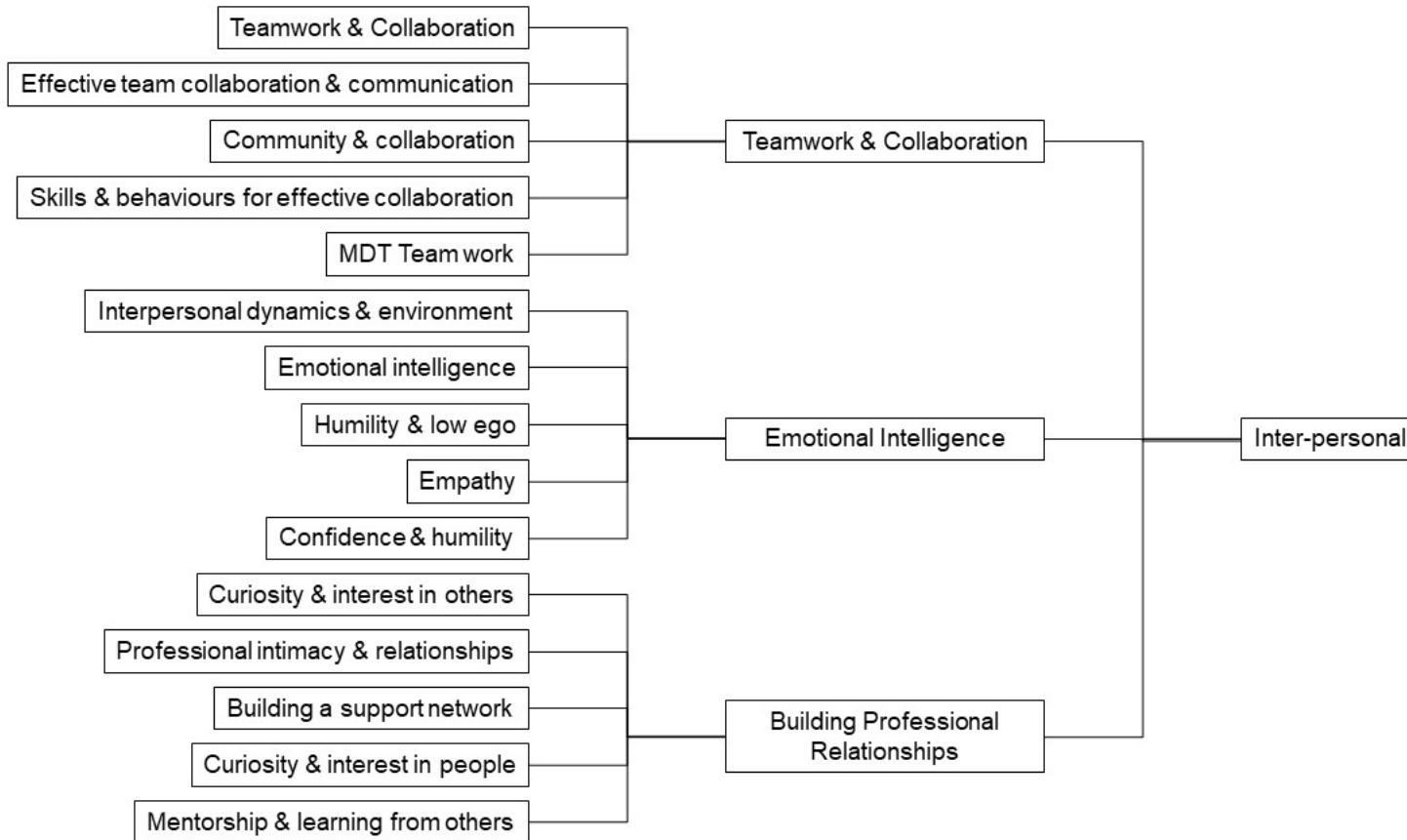
Figure 19: Inter-Personal Skills identified by Practitioners and Leaders as important to effective MDT working.
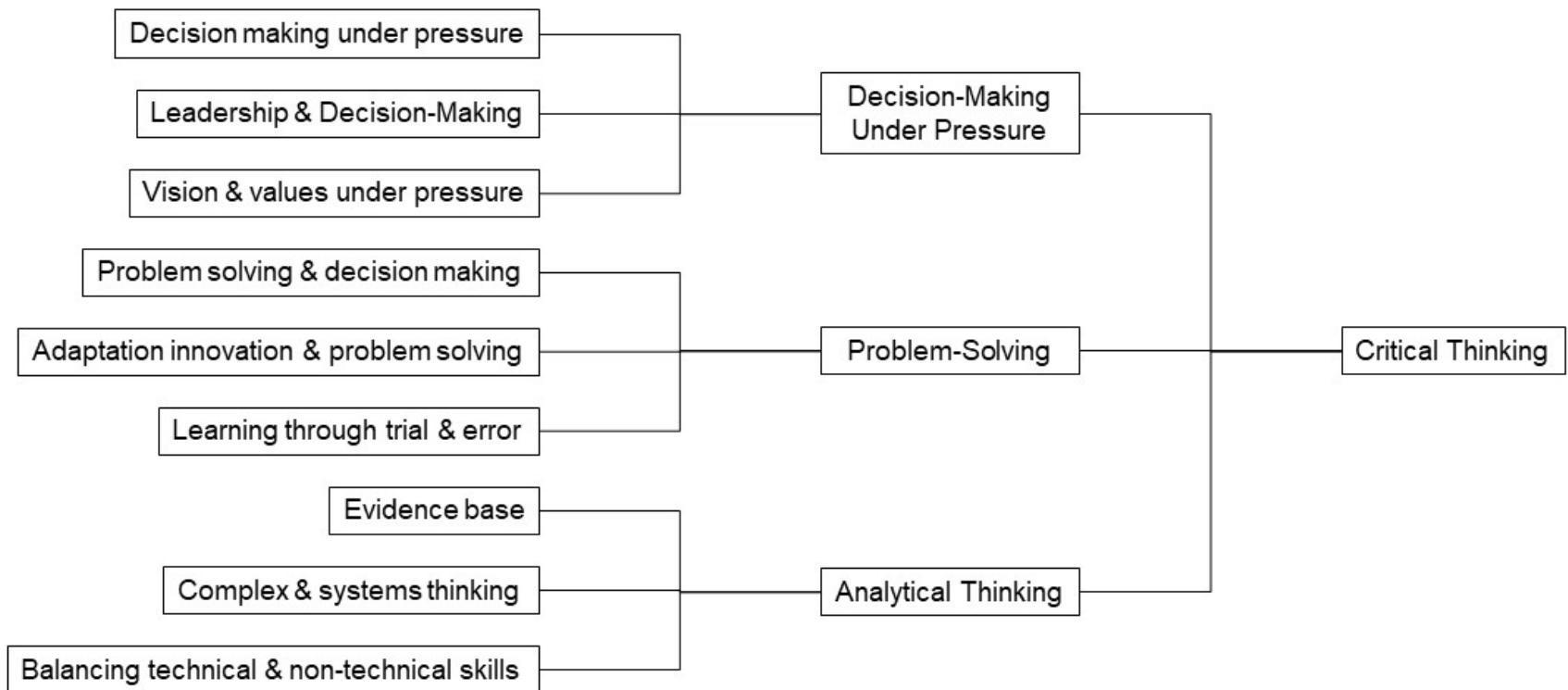
Figure 20: Critical Thinking Skills identified by Practitioners and Leaders as important to effective MDT working.

Knowledge exchange and the need for T-Skills

Industry is evolving towards a knowledge economy where the problems being faced are wicked and the solutions lie within multi and interdisciplinary fields. As such, there is a need for 'T-shaped' professionals; individuals that possess a depth and breadth of knowledge (Conley et al., 2017) who can work in cross disciplinary ways. It is worth considering what breadth of knowledge means. When cross-discipline teams are working together the benefit to problem-solving comes from cognitive diversity (Hong & Page, 2004). If a practitioner has breadth of knowledge that reaches into other professional domains, it may help them to better understand how disciplines might collaborate, yet this may lead to inter-professional conflict and duplication of effort as boundaries between disciplines are breached (King et al., 2024b). Topical issues raised in Chapter 3 ([Page 43](#)) (King et al., 2024a) for MDT practitioners aspiring to work in sport is (1) the breadth of tasks demanded within role descriptions and (2) job creep, where the practitioner is continually expected to take on more responsibilities alongside their main job. When roles are broad, staff are very busy fulfilling a varied remit much of the delivery must be light touch and does not go beyond a superficial level. Kahneman and Klein (2009) refer to this dilution as 'fractionated expertise'. Perhaps this highlights a trade-off between depth and breadth of knowledge and its usefulness in multi-disciplinary knowledge-based work.

Findings from Chapter 5 (King et al., 2025) argued that practitioners operating in sport work with complex problems. Indeed, high-performance sport organisations and teams must constantly evolve, innovate and create new solutions to stay ahead of the competition. The line where a practitioner is required to be a 'skilled doer' delivering procedural routines within their discipline or an 'innovative problem-solver' and knowledge worker operating as part of an MDT is blurred. Certainly, the need for collaboration in sport is not questioned (Burns & Collins, 2023) and as such, it is argued here that practitioners operating in sport require T-Shaped skills ([Figure 21](#)).

Inter-professional skills

Meta-cognitive skills	Inter-personal skills	Critical Thinking skills
Metacognition is the process of awareness of the way in which we think	Abilities that facilitate effective communication, collaboration, and relationship management, enabling individuals to interact with others.	The capacity to analyse, evaluate, and synthesize information objectively, leading to informed judgments and effective problem-solving.

Soft – non-technical skills

Technical skills

Proficiencies and expertise in specific tools, technologies, and processes related to a particular field, enabling the practical application of knowledge to accomplish tasks.

Hard – technical skills

Intra-professional skills

Figure 21: T-Skills required by MDT practitioners to be effective in high-performance sporting contexts.[13]

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[13]In the T-shaped practitioner Figure, the vertical represents technical 'hard' skills and expertise. The horizontal non-technical 'soft skills' are the meta-cognitive, inter-personal and critical thinking skills identified by leaders and practitioners working in high performance sport contexts and deemed critical for practitioners operating in MDTs. The more emphasis placed on 'intra-professional' deep technical expertise, the less accessible and perhaps useful this knowledge might be inter-professionally (across professional domains).

Acquiring horizontal skills as a practitioner

It is known that vocational and higher education courses tend to focus on the hard technical competencies and professional knowledge associated with the domain expertise. Within these courses are nested 'non-technical' skills. Critical thinking, inter-personal and meta-cognitive skills are often covert, learned implicitly or deemphasised in favour of the more transactional knowledge associated with course curriculums. If industry is moving towards a knowledge era (Whitley et al., 2022) where solutions emerge through interdisciplinary methods, then learning mono-disciplinary expertise in isolation, without the skills to blend and combine that expertise with others, may be problematic in the future and consequently highlights some of the current challenges in multidisciplinary team practice.

Figure 11 presented within the results of Chapter 4 (King et al., 2024b) demonstrates what practitioners articulate 'good' looks like in MDTs in sport having learned through reflection, failure, and challenges. This raises questions derived from the investigations presented in the current body of work over whether the nested horizontal skills that practitioners should acquire through their vocational and higher education training translate well into applied practice. It further suggests that meta-cognitive (reflection) and inter-personal skills are shaped in the wild, within context and that learning is acquired through hard knocks and setbacks (see Chapter 4). Purposefully equipping practitioners with these skills, over emphasising their importance alongside technical capability may translate into better outcomes within and across professional disciplines and better prepare practitioners for the realities of working in the field.
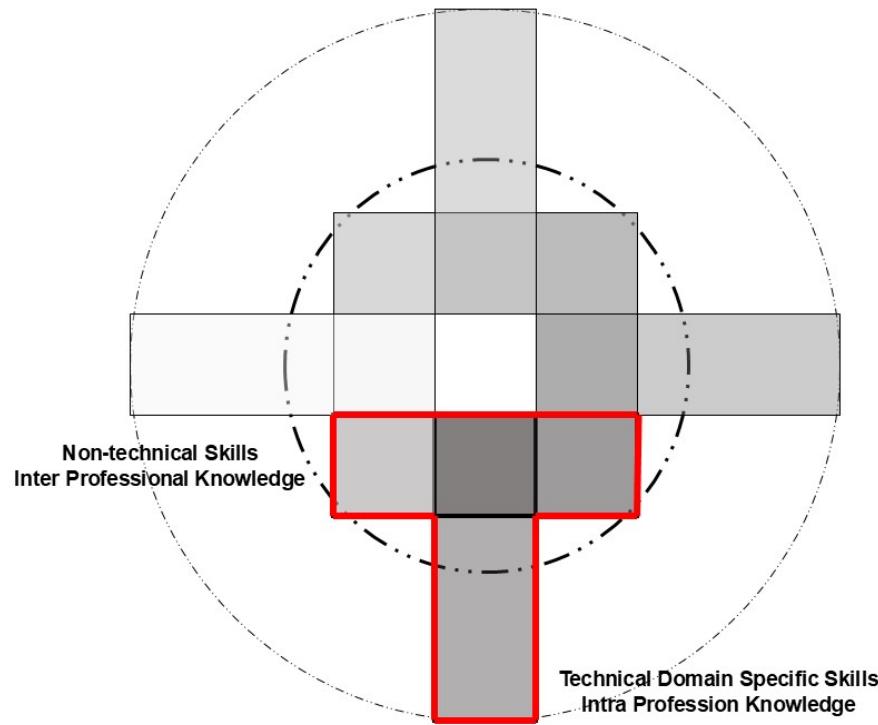
Figure 22: The T-Shaped practitioner: Illustrating the importance of horizontal skills in integrating 'inter professional' domains in practice[14].

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[14]The conceptual Figure illustrates the importance of the horizontal skills. Each overlapping 'T' represents a practitioner from different disciplines. The intra-professional (vertical) knowledge is less accessible to the rest of the team as it is deep and specific to that professional domain. The horizontal (meta-cognition, inter-personal, critical thinking) skills are what makes knowledge accessible to the rest of the team and enables the combining of knowledge through shared mental models and team cognition.

From the investigations published in Chapters 3-5, it was considered whether deep expertise is better suited to mono-disciplinary working, and how then, can this expertise be accessible and useful to team endeavours. Page (2019) argues that the combination of different individual's cognitive repertoire creates better outcomes than could be delivered by an individual alone. It may be argued that by combining and sharing expertise, integrating perspectives and knowledge can generate vivid, detailed and fuller pictures and understanding than could be generated alone (King et al., 2024b) and is conceptualised in Figure 22. Building new tools (a practitioners applied skills) by blending skill sets through shared process might unlock some of the professional dogma that exists within MDT practice and create new solutions to those hard to solve problems. The concepts of team cognition (Aggarwal & Woolley, 2019), shared mental models (Rothwell et al., 2020), team performance (Salas et al., 2008) and team/shared expertise are only possible through communication and collaboration. Practitioners who are curious, open to sharing, and not overly protective of their intellectual property, as well as those with strong interpersonal skills and emotional intelligence, are essential for fostering collaborative environments. Additionally, self-awareness, emotional intelligence, and the ability to reflect are crucial for managing behaviour and ego, enabling practitioners to effectively access and share knowledge with others. Finally, high levels of critical thinking skills are vital for problem-solving, decision-making, and using judgment to share and develop expertise (see Figure 11, p75).

Conclusion

In high performance sport, the role of practitioners is increasingly complex, demanding both deep technical expertise and the ability to collaborate effectively within MDTs. The importance of developing "T-shaped" practitioners who possess both vertical technical skills and horizontal soft skills, such as critical thinking, interpersonal, and metacognition is supported by the findings derived from the investigations presented in this thesis (King et al., 2024a; King et al., 2024b; King et al., 2025). The value of these non-technical skills is clear in their contribution to applied problem-solving, decision-making, and the integration of diverse perspectives within teams. As performance sport continues to evolve towards what Page (2019) refers to as a knowledge-based economy, the ability to navigate and blend expertise across disciplines will become increasingly essential. Therefore, fostering horizontal skills alongside technical expertise will be critical for practitioners aiming to thrive in high-performance sport environments, ultimately enhancing team performance and innovation. This underscores the need for educational programs and professional development to emphasise not just the acquisition of technical skills, and the cultivation of the broader cognitive and interpersonal capabilities situated within sporting contexts that are vital for effective MDT functioning.

Practical considerations and link to the body of work

Hard technical skills are highly valued by practitioners, leaders, and organisations. However, when asked, inter-personal, critical thinking, and metacognitive skills were identified as essential for effective MDT work. This highlights a gap between how practitioners operate individually within their disciplines, where high levels of technical expertise are required although are often applied to straightforward problems with clear solutions, and how these

technical skills are perceived within the MDT. In team settings, technical skills are in fact downplayed yet still recognised as important, while horizontal 'non-technical' skills are strongly emphasised as a critical requirement of success within MDTs.

Building on the arguments presented in Chapter 7.2, where greater emphasis is placed on understanding the problem type and establishing the need for collaboration, tackling truly complex problems requires cognitive diversity. To access and leverage this enhanced problem-solving capability, practitioners need the T-shaped skills (Figure 21) that enable them to work collaboratively and effectively within an MDT.   In Chapter 4, it was suggested that there was a dark reality to working in MDTs through which a utopian view emerged (King et al., 2024b), the results presented here illustrate a gap in how practitioners are prepared for working in industry and what they are required to do in practice which might be the protagonist to some of the issues raised:

- Technical skills are over emphasised by employers and within service areas/ disciplines.
- Practitioners are trained to deliver within their professional discipline, not through an inter-professional team (Academic and Professional Training)
- Non-technical skills are nested, deemphasised and learned on the job
- Leaders do not discriminate between problem types and purposefully leverage the knowledge that exists within the MDT to attend to them.
- Practitioners are not encouraged to blend skills, expertise and knowledge, and likely do not initially have the capability to do so.

Having established the need for 'T-Shaped' practitioners by drawing upon the results developed for Chapters 4 and 5 (King et al., 2024b; King et al., 2025) and considering them against the finding that practitioners at times, work with complex problems, it is worth considering how leaders leverage the vertical and horizontal skills that practitioners possess. Leaders attend to performance problems through purposeful Plan-Do-review processes and strongly emphasise the importance of their work attending to the team.   How they cycle in different problem-solving approaches to polarised problem types presents an opportunity for leaders and will be the focus of the third perspective piece (section 7.4).

7.4 Practical Perspective 3: Design thinking as a method to enhance problem-solving capability of MDTs

Chapters 3 and 4 in this thesis highlight a significant disconnection between how practitioners operate as individuals and what is expected of them within an MDT context.   There is a clear divergence between practitioners' typical delivery approaches centred on processes and protocols, and the demands of addressing unfamiliar, complex problems (King et al., 2024a). Findings from Chapter 4 (publication 2) indicate that practitioners benefit from strong leadership and positive team dynamics (King et al., 2024b). Chapter 5 further underscores the role of leadership in aligning teams, creating clarity, and establishing processes to enable

collaborative problem-solving (King et al., 2025). Both practitioners and leaders however expressed uncertainty about the term 'problem-solving,' despite its frequent use in their discourse (King et al., 2024b; King et al., 2025). This tacit yet unclear understanding of the term is problematic as discussed in the first perspective of Chapter 7 (Section 7.2).

If an interdisciplinary approach (integration and blending of the skills and expertise of the team to attend to novel problems (See Figure 22) (Doherty, 2013) is required, the final perspective of this chapter considers whether practitioners and leaders possess the capabilities or processes to engage in purposeful and deliberate problem-solving methodologies. Insights from this thesis Publication 1, 2 and 3 presented in Chapter 3, Chapter 4 and Chapter 5 suggest that practitioners, MDTs, leaders, and sporting organisations continually navigate and address problems both individually (King et al., 2024a) and collectively, across teams (King et al., 2024b) and organisational hierarchies (King et al., 2025), often without centralising these efforts within their methods or approaches.

Leadership as a Problem-Solving Endeavour

Chapter 5 argued that framing MDT work through the lens of problem-solving could address many of the issues identified by practitioners and leaders (King et al., 2025). Below are some key advantages of adopting a problem-solving framework in MDTs based on the findings in Chapter 5 (Publication 3):

1. ***Strengthened Shared Purpose:*** Establishes a stronger sense of alignment and shared goals across practitioners and the MDT.
2. ***Encourages Innovation:*** Moves practitioners beyond their routine 'tried and tested' delivery processes, enabling them to approach problems creatively and develop innovative solutions.
3. ***Promotes Collaboration:*** Provides a compelling reason for practitioners to collaborate, working together to solve shared challenges and find effective solutions.
4. ***Enhances Information Sharing:*** Positions information sharing as an active, collaborative process, reducing challenges posed by hierarchies, trust issues, and power dynamics.
5. ***Breaks down Silos:*** Minimises disciplinary silos and entrenched divisions by encouraging professionals to contribute unique perspectives and expertise to shared problems.
6. ***Facilitates Healthy Conflict:*** Reduces the risk of personal or affective conflicts while increasing the potential for productive debates, diverse opinions, and cognitive/task conflict, which are hallmarks of effective inter-professional teams.

The Cost of Collaboration

Collaboration is not a panacea; It is resource intensive, requiring significant time, effort, and teamwork (Burns & Collins, 2023). Challenges arise when collaboration is expected or demanded without clear purpose or direction in place. It must be reiterated that practitioners reported working with simple problems using procedural and protocol type approaches where

they rely on intuitive type expertise to deliver their outcomes (King et al., 2024a). In this circumstance, the need for collaborative problem-solving is negated in favour of 'business as usual' processes delivered through individual practitioners.

Evaluating the findings from Chapter 3 (Publication 1) reveals that practitioners possess cognitive flexibility, agreeing with Kozlowski and Ilgen (2006), enabling them to toggle between different types of problems and between procedural and innovative problem-solving approaches. Therefore, differentiating between problem types and tailoring approaches accordingly becomes critical for leaders to leverage cross-functional MDT strategies effectively within the sporting context. Done effectively, the leader can enhance clarity of purpose for the practitioner and give them a much greater confidence in their contribution within their professional sphere of competence and in circumstances where they need to collaboratively problem-solve.

Design thinking to support cognitive flexibility across MDTs

The results in Chapter 5 (publication 3) highlighted the theme of 'performance problem-solving' within the context domain (see Figure 13) (King et al., 2025). This theme encompassed sub-themes such as cognitive diversity and integration, reimagining performance, and the plan-do-review process. Within the people domain, the theme of 'fostering environments' included sub-themes like clarity and alignment, time and space, as well as modelling and enabling desired behaviours (King et al., 2025). These findings present a clear opportunity (as argued in Chapter 5) to integrate design thinking methodologies (Foster, 2021) into the working processes of performance support and MDTs in sport.

The double diamond design thinking methodology presented in Figure 23, first proposed by the UK Design Council (Kochanowska & Gagliardi, 2022) supports creativity and innovation and has been widely adopted across various industries such as IT, Business, Education, Engineering and Medicine (Dorst, 2011), offering a structured process for addressing the ill-defined, complex problems faced by MDT practitioners in sport. This framework resonates with leaders' who expressed a need to reimagine performance. The methodology emphasises two key phases:

- **Divergence (creating space and possibilities)**: This phase involves generating novelty through brainstorming, freewheeling, snowballing, ideation, and creativity, all with minimal constraints.
- **Convergence (focus and direction)**: This phase emphasises activities such as debating, narrowing options, weighing alternatives, constraining, testing, triangulating, and building consensus.
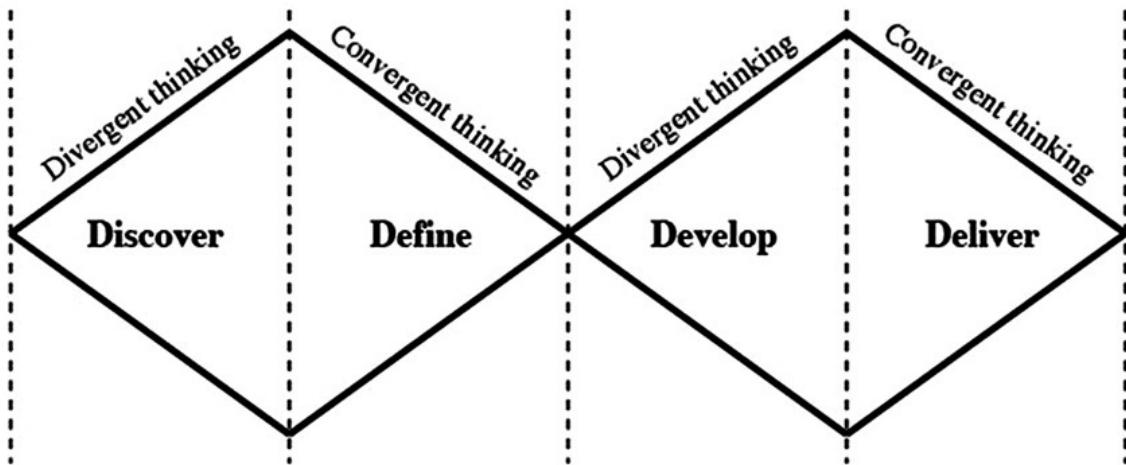
Figure 23: Double Diamond Design Thinking Process taken from UK Design Council[15] (Kochanowska & Gagliardi, 2022).

To support toggling between different cognitive styles, leaders can adopt principles of design thinking, fostering both divergent (creating space and possibilities) and convergent (focusing and directing) mind-sets within the team during problem-solving processes (illustrated in Figure 23 (UK Design Council). This approach aligns seamlessly with the findings of Chapter 5 (publication 3) and complements the plan-do-review framework identified within the performance problem-solving theme within the context domain (King et al., 2025) identified through research presented in this thesis.

To complement Figure 23, a four-stage process that aligns with the double diamond design thinking process that leaders could adopt within a problem-solving approach was created and described further in Figure 24. The infographic style figure identifies the stages of the problem-solving process and within each step, demonstrates the requirement for divergence (along the top of the Figure) and convergence (along the bottom of the Figure) as illustrated through a series of example questions that can be asked (Figure 24). In adopting this framework/approach, leaders become facilitators of a process in which their job is to purposefully assist the practitioners within the MDT toggle between different thinking styles and approaches as they progress through the steps. By employing these structured yet flexible approaches, leaders can enhance cognitive flexibility and by accessing the cognitive repertoire of the team, foster greater problem-solving capability within multidisciplinary teams.

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[15] https://www.designcouncil.org.uk/our-resources/the-double-diamond/
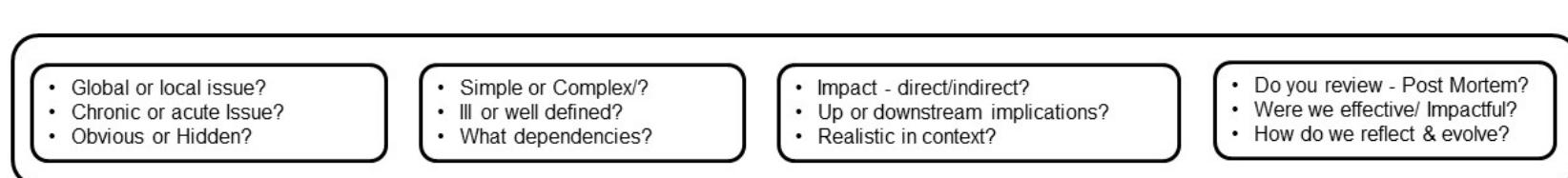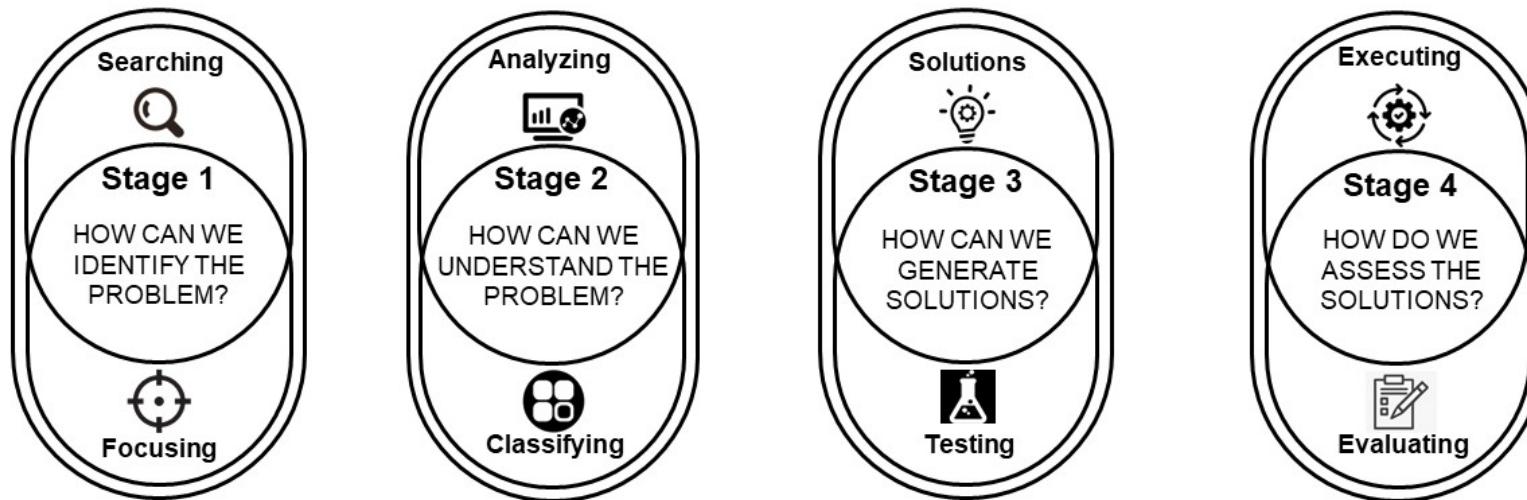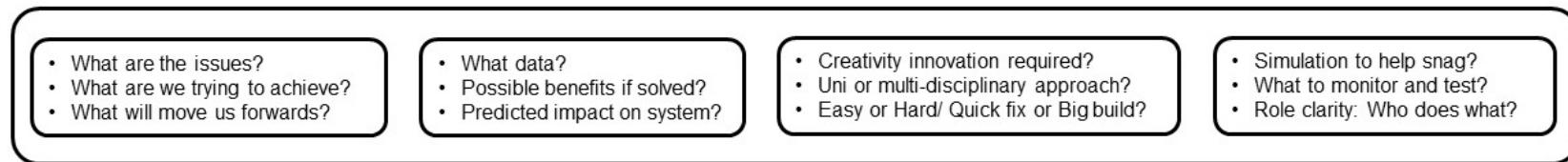
Figure 24: Four stage process for problem solving using the double diamond design thinking approach.

The four steps can be broken into a divergent (along the top) and convergent (along the bottom) thinking styles and approaches and are supported by a series of question that the leader could ask the practitioners.

The research presented in this thesis identified that practitioners, MDTs, and leaders often feel uneasy with the concept of problem-solving (King et al., 2024b; King et al., 2025). The interpretation of findings suggests that many struggle to clearly articulate what it entails and how they implement it, despite its frequent use in organisational discourse (King et al., 2024b; King et al., 2025). To address this, targeted training is necessary to help sporting organisations, leaders, and teams develop a deeper understanding of the importance of problem-solving capabilities within their specific contexts.

For this training to be effective, it is crucial to recognise that practitioners often default to 'business as usual,' relying on traditional solutions within their specific disciplines (King et al., 2024a). This approach can inhibit collaboration and limit the exploration of alternative methods. Acknowledging this tendency can open pathways to more innovative and collaborative problem-solving strategies.

Moreover, many leaders have progressed from practitioner roles, where technical expertise and discipline-specific skills are highly valued. This transition can perpetuate a culture in which leaders prioritise technical proficiency over fostering collaboration and leveraging the cognitive diversity within MDT. Chapter 5 (publication 3) of this thesis underscores the assumption that teamwork within MDT will naturally emerge, without deliberate effort to design and nurture it (King et al., 2025). This identified and represents a missed opportunity for leaders to intentionally harness the diverse perspectives within their teams through collaborative, problem-solving methodologies such as design thinking (Foster, 2021).

When dealing with complex or wicked problems, both the definition of the problem and the development of solutions require significant time and effort (Vaughan et al., 2019). This is challenging in organisations where practitioners and leaders are often overwhelmed by day-to-day responsibilities as identified by the investigation in Chapter 5, (King et al., 2025). This leaves little capacity to pause, reflect, and consider alternative approaches. Asking busy practitioners to step away from their operational duties to adopt a more exploratory, problem-solving orientation involves inherent risks.

Collectively the investigations in this thesis reveal that practitioners and leaders often exhibit insecurities regarding their confidence and certainty in decision-making and problem-solving (King et al., 2024b; King et al., 2025). Adopting a problem-solving methodology challenges traditional notions of confidence by shifting the focus toward a learning orientation, where collaboration is central to both outcomes and solutions. This requires a fundamental change in approach, encouraging teams to invest more time and energy in addressing complex, ill-defined problems.

Ensuring that leaders and teams have the capacity and capability to engage with these challenges is critical. This involves fostering the skills needed to generate and implement solutions and creating a culture where collaborative problem-solving is prioritised and supported.

Conclusion

Leaders can access the cognitive diversity within MDTs by fostering a deliberate problem-solving approach. By emphasising the importance of team problem-solving capabilities, identifying key problems for the team to address, employing structured processes and methods, and facilitating effective collaboration, leaders can significantly improve problem-solving outcomes. Design thinking provides an effective framework for guiding teams through problem-solving, enabling individuals to toggle between the diverse thinking styles required to address complex challenges.

Encouraging cognitive flexibility, promoting teamwork through T-shaped skills, and employing deliberate processes to navigate problems highlight the critical role of effective leadership. A clear, structured approach not only supports collaboration and drives positive, impactful outcomes.

Practical Considerations and link to the body of work

There was clear evidence provided by practitioners in the body of the thesis suggesting that strong leadership is required by MDTs (King et al., 2024b), a finding that supports previous work (Jowett, 2024; Stewart et al., 2024a). Chapter 5 provides novel insights into how leaders operate and what they attend to when overseeing MDTs (King et al., 2025). Problem-solving is a requirement of both practitioners within their role and leaders of their teams (King et al., 2024a; King et al., 2024b; King et al., 2025). By shifting problem-solving from covert and implied (as identified in Publication 2 and 3) to overt and intentional through deliberate processes and approach, MDT working could become more purposeful and impactful whilst traversing some of the challenges and difficulties that have been outlined in Chapter 4 and 5. Alongside this, complex problem-solving gives a strong reason for collaborative team working within an MDT and provides further justification for practitioners to develop and apply the T-Skills that have been identified (Chapter 7.3) as critical requirements of practitioners.

7.5 Conclusions from a Practical Perspective

The body of work presented in this thesis highlights a misalignment between the knowledge, skills, and service delivery of an MDT practitioner focused on their specific professional discipline and those of an MDT member who integrates their expertise and collaborates within an inter-professional team to solve complex problems (King et al., 2024a; King et al., 2024b; King et al., 2025). In addition to this and based on the findings of study 1, 2 and 3 three perspective pieces have been presented (Chapter 7) to highlight the importance of striving for clarity in what problem-solving is.

Perspective 1 (Chapter 7.2) argued that practitioners and sporting organisations would benefit from adopting a more considered approach to problems and their solutions based on the findings of the published studies presented in Chapter 3 and Chapter 4 (King et al., 2024a; King et al., 2024b). Enabling teams to rationalise decisions and differentiate between problem types and approaches would provide greater clarity on the issues that require attention, while encouraging a shift away from siloed, discipline-specific practices.

In the second perspective piece ([Chapter 7.3](#)), drawing on unreported data captured through the studies presented in Chapter 4 and Chapter 5 (King et al., 2024b; King et al., 2025), it is strongly argued that there is a case for practitioners to develop their T-Skills whilst posing important questions over the value of collaboration over cooperation. The so called non-technical (meta-cognitive, inter-personal and critical thinking) skills required by practitioners to thrive in MDT contexts are not purposefully or overtly developed through training nor is what collaboration and the integration of skills and expertise across disciplines looks like. Indeed, these skills are most likely learned on the job and often only acknowledged as an important requisite due to challenges, failures and hard knocks experienced through practice (King et al., 2024b).

The final perspective ([Chapter 7.4](#)) underscores the importance of the effective leadership that practitioners identified as critical in Chapter 4 (King et al., 2024b) and draws upon the findings from our leaders presented in Chapter 5 (King et al., 2025). Given the perceived need for practitioners to (in parallel) toggle between problem-types and contribute to complex problem-solving through the MDT approach, it is argued that leaders could adopt a position of *leadership* through the lens of problem-solving. Their role is to facilitate the team to effectively find and solve problems through a design-thinking methodology through which practitioners are encouraged to toggle between different thinking styles as they progress through the problem-solving process.

Chapter 8: Synopsis

8.1 Performance problem solving in high-performance sport – Problem-Solving Framework

The overarching aim of the collective body of work in this thesis was to explore how MDT practitioners in high-performance sport engage in problem-solving and decision-making, as well as how leaders leverage MDTs to enhance their effectiveness. The specific objectives included 1) Understanding the cognitive approaches and decision-making styles employed by MDT practitioners in high-performance sport, 2) Identifying the challenges and facilitators of effective MDT collaboration before 3) examining how high-performance leaders optimise the impact of MDTs to drive performance outcomes. Overall, it was hoped that the research findings would serve to better understand the role of cognitively diverse MDTs, create greater clarity on the term problem-solving in high-performance sporting contexts and develop a fuller view of the need for collaboration in these settings.

Findings from this body of work highlight the complexities of decision-making, problem-solving, and leadership within MDTs in high-performance sport. Practitioners navigate a range of cognitive approaches, balancing intuitive and rational decision-making without a singular, clear framework guiding their work. Developing metacognitive strategies and reflective practices could enhance their ability to apply the right-thinking skills in different contexts. Within MDTs, assumptions about teamwork are challenged, revealing a reality marked by uncertainty, conflict, and the need for strong leadership. Effective collaboration relies on psychological safety, shared goals, and clarity in decision-making. Leaders, operating in complex and uncertain environments, must embrace ambiguity, leverage diverse expertise, and foster adaptability within their teams through a people and context domain to drive success in high-performance sport.

The following section of the synopsis has been developed to draw together the key elements from the investigations that have created our different lenses on problem-solving for high-performance sport framework (Figures 25, 26, 27 & 28). The lenses are identified as 1. **Defining the Problem-Space** (Figure 25); 2. **Problem Types and Approaches** (Figure 26); 3. **Individual Practitioner and MDT lens** (Figure 27) and 4. The **Leadership and Organisational lens** (Figure 28). Initially, the current chapter critiques problems and how problems present in the context of such environments before each lens is presented and supported by critical discussion. The section concludes with Table 12 which presents a detailed breakdown of the lens figures that constitute the problem-solving framework. It outlines their individual components, relevant supporting references, and links to specific sections within the thesis, illustrating how the framework has been developed and contextualised throughout the study.

The lenses developed on performance problem-solving through this research provides figures and frameworks, practical applications and considerations for practitioners, teams, leaders and organisations. The intention within this synopsis is to critique each 'lens' individually and highlight the innovation behind how they were developed and how this work could move professional practice forwards in high performance sport contexts.

8.2 Defining the Problem Space

First, it is important that effort is made to develop practitioners, teams and leader's confidence and understanding of different types of problems. From the findings of this thesis (Chapter 4 and 5 (King et al., 2024b; King et al., 2025)), it was observed that practitioners and leaders in high-performance sports often experience discomfort with the term 'problem-solving' despite its widespread use in the literature (Pitt et al., 2020; Reid et al., 2004), across the field, and among the participants of our studies. This highlights a need for more intentional support in embracing the term within high-performance sports. As a result, a stronger, purpose driven approach is recommended to clarify what problem-solving entails and to foster a shared understanding of its meaning within the sporting context.

Problem-solving suggests engagement with a process, it requires critical thinking and is a very useful tool for enhancing team collaboration and (depending on the problem), justifies the need for multi or inter-disciplinary working. Consequently, Figure 25 has been developed through the collective results of the three investigations presented in the thesis (Chapter 3, 4 and 5 (King et al., 2024a; King et al., 2024b; King et al., 2025) and considers the literature that discriminates between different problem-types (Alford & Head, 2017; Kitchner, 1983; Schraw et al., 1995).

In clearly defining the problem space, individuals must categorise problems as either simple, well defined and tame, or ambiguous, i.e. complex, ill-defined or wicked. Additionally, they should consider whether problems are overt and explicit or covert and implicit. This second exploratory layer of the problem space allows the team to look beyond the obvious and into the dark spaces where sometimes problems hides. Teams can carefully consider through purposeful discussion, what the problems are, where they exist (Figure 25 – outer ring) and how they might go about addressing them. Approaching 'problem finding' or the purposeful identification of problems as a distinct task by itself, is deliberate and purposeful. A task such as this, raises the team's awareness of the range and breadth of problems that they must contend with and solve whilst engaging their critical thinking and meta-cognitive skills.
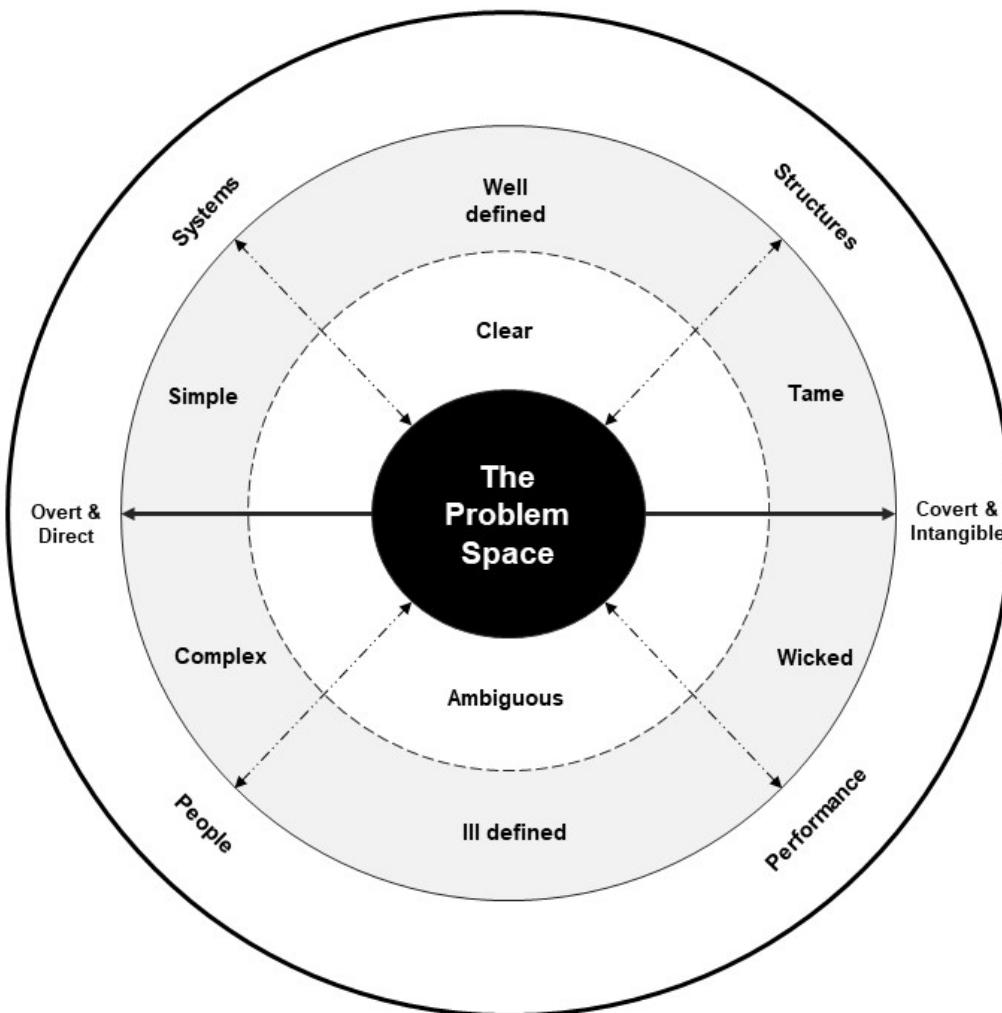
Figure 25: Defining the Problem Space.

8.2.1 Defining the Problem Space - Figure Overview

Figure 25 outlines a dynamic Problem Space within organisations, illustrating how various types of problems can emerge in different contexts, driven by both leadership and practitioners. It categorises problems along several dimensions: clear vs. ambiguous, covert vs. overt, and emphasises the dual influence of top-down (leadership) and bottom-up (practitioners) in addressing these problems and is derived directly from the findings in this thesis.

8.2.2 Structure of the Problem Space – Figure 25

Centre Circle (The Problem Space):

The core of the Figure represents the Problem Space, where issues that an organisation, leadership, teams or practitioners needs to address exist. Problem Types:

- Clear or Ambiguous: Well-defined issues (clear) vs. more complex, poorly understood issues (ambiguous).
- Covert or Overt: Problems can either be easily seen (overt) or hidden within organisational dynamics (covert).

Outer Circle (Influencing Factors):

- The outer circle includes Systems, Structures, Performance, and People. Each of these factors plays a role in shaping the problem space and can be either overt or covert.
- Systems: Ways of working, processes or systems (IT/technology; flows; reporting) that are utilised across an organisation.
- Structures: How the team are organised or the hierarchy through which they are organised.
- Performance: The performance and well-being of the athlete and the impact of the team on performance.
- People: How individuals and the team behave, the clarity they have, how aligned they are etc.

Utility:

The Figure can be used by practitioners, teams and/or leaders to help map the breadth and range of problems that are being faced within the context or organisation. The figure has a range of utilities which can be deployed either by individuals or used as a facilitation tool to support a deliberate process of identifying problems to be addressed.

Flexible Problem Categorisation:

- The figure is versatile, allowing organisations to classify problems based on multiple criteria. Rather than viewing problems in fixed quadrants, the framework recognises that systems, structures, performance, and people-related challenges can

simultaneously be clear or ambiguous, overt or covert, depending on their nature and context.

Context-Sensitive Responses:

By defining problems according to these categories, practitioners, teams and leaders can better identify and tailor the appropriate solutions:

- Clear and Overt: Immediate operational or performance fixes, such as role clarity or process improvements.
- Ambiguous and Covert: Systemic or structural issues that might need more nuanced, long-term strategies, such as cultural shifts or restructuring.

Enhanced Organisational Alignment:

- The figure helps teams and leadership align by clarifying the nature of problems and the appropriate approaches based on who (leadership vs. practitioners) is best positioned to tackle the issue and how it should be approached (whether it is clear or ambiguous, overt or covert).

Strategic Decision-Making:

- By clearly defining the problem space, organisations can allocate resources more effectively. For instance, well-defined problems might be resolved through existing processes, while ill-defined, "wicked" problems may demand creative, cross-disciplinary approaches.

Enhancing Team Communication:

- Teams and leaders can use this framework to enhance communication by ensuring that everyone is aligned on the nature of the problem. This shared understanding can reduce confusion and promote more effective collaboration.

Figure 25 provides a structured way for teams to define their problem spaces, allowing them to choose the most appropriate methods and resources for addressing each type of issue. By identifying whether problems are well or ill-defined, simple or complex, overt or covert, organisations can create greater clarity and efficiency in their problem-solving processes.

8.3 Problem Types and Different Approaches

Having defined the problem space with the support of Figure 25, Figure 26 depicts and introduces the 3 lenses of problem-solving developed through the findings of this thesis. These include the leadership/organisational, MDT and practitioner lens (as depicted by the outer, middle and inner rings within Figure 26). Within Figure 26, problem-solving is defined across a continuum from well-defined to ill-defined as suggested by Schraw et al. (1995). The term 'well-defined' was selected because it implies that problems are understood, it is already known what needs to be done and very little to no 'problem-solving' is required as an array of available solutions already exist.

The term ill-defined problems suggest a need to give the problem more definition and greater understanding. This is useful to leaders and practitioners as it suggests an exploratory mind-set which potentially gives them permission to explore the problem to give it greater clarity. Capitalising on this, leaders can create space, time and freedom to think as a team and collaboratively explore what problems to attend to. Having discriminated between problem types, the Figure then outlines how each stakeholder within their lens contributes to problem-solving.

Through the practitioner lens and supported by the study outlined in Chapter 3 (King et al., 2024a), discrimination between intuitive expertise for well-defined problems and the need for logic and rationale when problems are ill defined were challenged. The MDT lens, developed through the second investigation presented in Chapter 4 highlights the importance of role clarity, shared understanding and psychological safety in driving effective MDT outcomes whilst cognitive diversity, context and adaptability are critical when problems are complex or ill defined (King et al., 2024b). Through the leadership lens discussed in Chapter 5, it is noted that they must attend to the people domain (King et al., 2025), this is especially important in mobilising a collaborative open environment where practitioners can express their views and share their expertise. More challenging is what leaders focus their (and by default the teams) attention on within the context. Good judgement, problem-solving approach and how they navigate complexity (King et al., 2025) will potentially determine what the team focuses on and how successful they are.

Systems can be defined as methods, approaches and processes that teams must work with or through (Balague et al., 2013) whereas structure in general, is how the team is organised (Pol et al., 2020). The findings from this thesis, particularly in Chapters 4 and 5 (King et al., 2024b; King et al., 2025), suggest that systems and structures can contribute to covert implicit problems arising either from the organisational level (top-down) or the practitioner level (bottom-up). These problems may require direct intervention, or alternatively, addressing them at (or through) the system/structure level can serve as a strategy for solving complex challenges. Purpose is critical for individuals, the team and the organisation. Purpose must be clear, coherent and support alignment of goals, tasks and processes and cascades both down and up through the different layers and lenses. Planning at the organisational, team and practitioner level ensures alignment of goals, milestones and deliverables across all layers of an organisation.
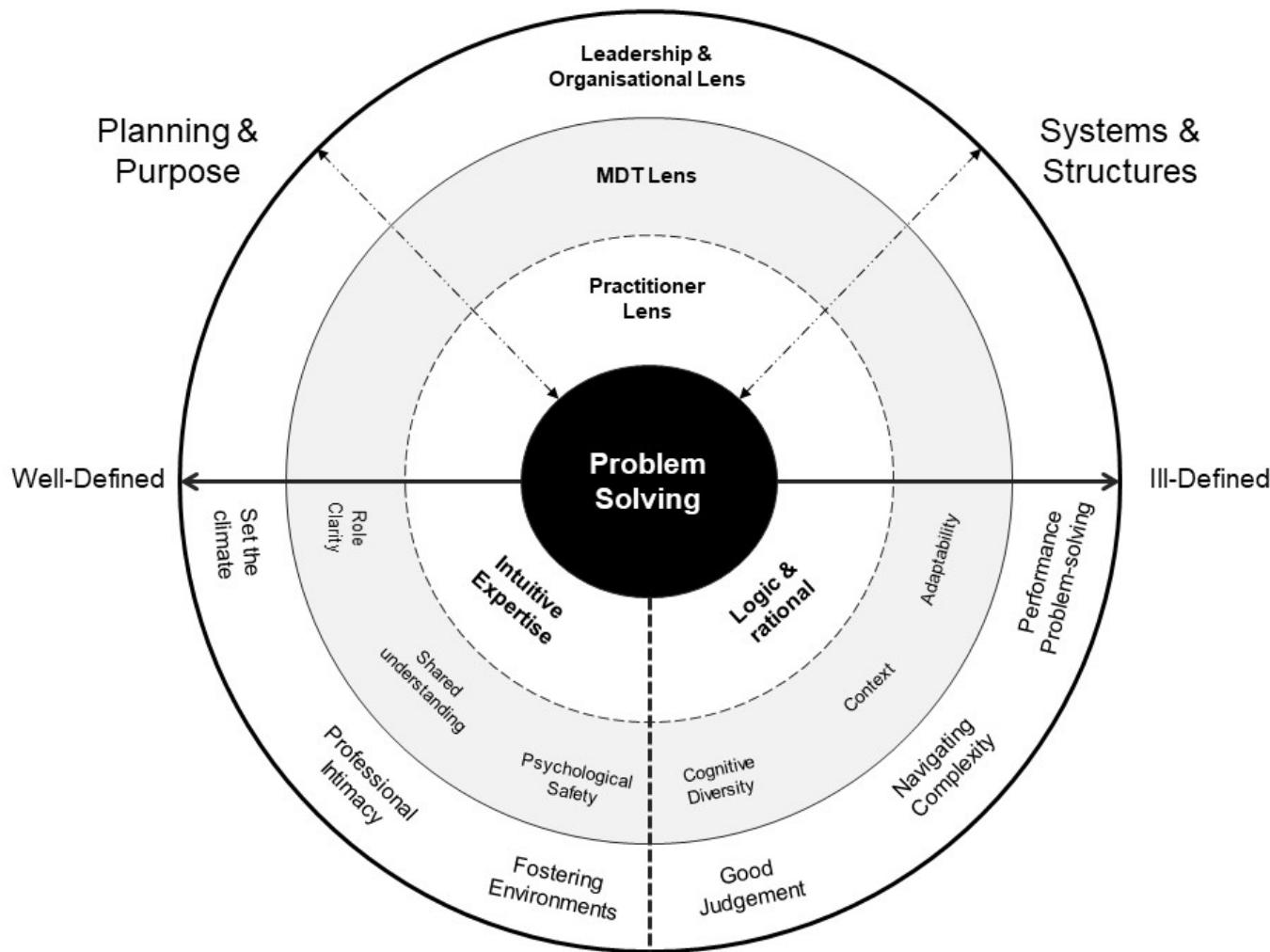
Figure 26: Problem type and approaches through different lenses.

8.3.1 Problem type and approaches through different lenses – Figure Overview

Figure 26 outlines problem-solving in high-performance organisations using three distinct lenses: Leadership & Organisational, Multidisciplinary Team (MDT), and Practitioner lenses. The diagram categorises problems along three axes, Well-Defined vs. Ill-Defined and Planning & Purpose vs. Systems & Structures.

8.3.2 Structure of the Problem and Approach lens - Figure 26

Centre (Problem Solving):

- The core of the Figure is problem-solving, where teams, practitioners, and leaders work together. Problem-solving is influenced by both intuitive expertise (relying on experience and instinct) and logic & rational approaches (structured, analytical thinking).

Axes:

- Horizontal Axis: Problems range from Well-Defined (simple, tame) on the left, to Ill-Defined (complex, wicked) on the right.
- Vertical Axis: The first indicates a focus on Planning & Purpose (organisational strategies and goals), while the second focuses on Systems & Structures (organisational dynamics, workflows, and interpersonal relationships).

Outer Layer (Lens Perspectives):

- Leadership & Organisational Lens: This lens emphasises planning, purpose, and broader system-wide strategies. Leaders need to foster cognitive diversity and adaptability to navigate ill-defined problems, while maintaining role clarity and professional intimacy for well-defined issues.
- MDT Lens: A multidisciplinary team lens stresses collaboration, shared understanding, and fostering environments that support problem-solving by drawing from diverse perspectives.
- Practitioner Lens: This focuses on the day-to-day application of professional expertise, including psychological safety, good judgment, and developing role clarity within well-defined spaces.

Utility:

Figure 26 presents a tool to aid leaders, teams and individuals to consider how they might find solutions to the problems identified (with the use of Figure 25) and begin to consider whether they are aligned in their approach. Talking through problems with the use of this Figure will rationalise the process of solving it, enabling the appropriate use of individual and team resources.

Classifying Problems:

- The Figure helps leaders and teams classify the types of problems they are facing. Well-defined problems are operational, clear, and straightforward, requiring role clarity and setting the right climate for teamwork.
- Ill-defined problems are more complex, requiring adaptability, cognitive diversity, and systemic approaches like altering team organisation or breaking down silos.

Applying Lenses:

- Each lens provides a unique perspective for problem-solving. For instance, Leadership focuses on high-level organisational strategies, MDT focuses on the collaborative power of diverse teams, and Practitioners apply tactical, experience-based knowledge.

Actionable Insights:

- The Figure provides guidance on what factors are important to focus on based on the nature of the problem:
- For well-defined problems: focus on role clarity, shared understanding, and setting the climate.
- For ill-defined problems: emphasise adaptability, navigating complexity, and promoting cognitive diversity to handle ambiguity.
- By integrating these lenses and insights, organisations can better approach a variety of challenges, from clear-cut operational issues to complex, systemic problems.

8.4 Problem-solving through the practitioner and MDT lens

The introduction to the lenses as depicted in Figure 26 presents an introduction/overview of each subsequent lens on problem-solving. Figure 27 presents the practitioner and MDT lens. This lens is an amalgamation of the findings of Chapter 3 and Chapter 4 (King et al., 2024a; King et al., 2024b) and acts as a practical resource and guide for how to leverage the problem-solving capability of individual practitioners within the MDT. It is argued in Chapter 7.3 that T-Skills, and particularly the horizontal meta-cognitive, critical thinking and interpersonal holistic skills (identified through the analysis from Chapter 4 and Chapter 5) will determine the success of individual practitioners working in MDTs. These skills, when developed explicitly to support the effectiveness of the practitioner will likely support their holistic development.

Supporting individuals as both experts within their disciplines and as practitioners collaborating within the team to appraise shared challenges, reflect on technical interventions, and evaluate inter-professional behaviour will intentionally enhance individual and team impact. It is further argued that taking time, creating space and emphasising the need for this development within sporting organisations will enhance MDT outcomes by developing the horizontal capacities of the team. Furthermore, organisations will benefit from assessing practitioner's awareness and capacity in each behavioural competencies within their

recruitment processes. Assessing behavioural and/or technical competencies will in part support the development of an effective cross-functional problem-solving team from the outset.

When problems are well-defined and simple individual ability should suffice in generating effective solutions (Page, 2007). It is likely that in these situations, practitioners can rely on heuristics, fast system 1 decision making and intuitive expertise (Kahneman, 2011; Kahneman & Klein, 2009). This type of delivery implies a level of experience and expertise that enables practitioners to access a bank of readily available solutions to problems rapidly and without of the need for deliberation.

Fast access to solutions and automation drives efficiency and reduces the need for collaborative problem-solving. Where problems are simple and well-defined, this lends itself to mono-disciplinary delivery solutions (as argued in Chapter 7.2). In these scenarios the work can be organised through routines, checklists, procedures and processes where traditional 'off the shelf' solutions can be unpacked and delivered. The practitioners recruited in Chapter 3 reported working with simple problems and through automated fast delivery methods (King et al., 2024a). Much of the work of the MDT happens 'within' disciplines constrained by professional boundaries and therefore, at the MDT layer (outer ring of the framework – Figure 27), communication, coordination and cooperation (Salas et al., 2018) of workflows and processes are critical, ensuring that practitioners and coaches are highly aware of what is happening across all aspects of delivery.

Distinction should be made between cooperation and collaboration; the former suggesting information is shared for visibility to support others planning or delivery processes with the latter demanding integration of workflows and methods where problem-solving is a shared endeavour.

In Chapter 3, results showed that practitioners reported working with complex problems (King et al., 2024a; King et al., 2024b). When the problem-solving type leans towards ill-defined, complex or wicked both critical-thinking and meta-cognitive skills are required. First, to discover problems and their potential root causes, which might be covert and implicit, teams need to consider both 'up stream', asking what is the antecedent of the problem and 'downstream', what are the consequences? This may help teams to uncover problems hidden from plain sight and focus attention and resources to help solve them.

When team attend to ill-defined complex problems, they will rely on more rationalised problem-solving approaches. Team's benefit from information and analysis, applying logic whilst rationalising what needs to be done and being purposefully deliberative in their decision-making style (King et al., 2025). This is challenging in high performance sporting contexts where practitioners must balance between delivering service within their professional silo whilst contributing to the broader context of the MDT.

Elite sport tends to be busy, result focused and dynamic so taking time to slow the MDT down, transition from delivery mode and into analysis mode can be challenging as discussed in Chapter 7.4. To attend to complex problems, MDT practitioners cannot rely on the automated delivery methods aligned to their intuitive expertise. Based on the findings from the body of work, it is likely that cognitive diversity of the team will provide better problem-solving capability. To leverage this diversity bonus, practitioners rely on openness and trust, shared

understanding (developed through discussions and debate) and role clarity (King et al., 2025) enabling more and better creative solutions to be tabled. It is therefore through this openness and willingness to share that shared mental frameworks, greater collaboration and integration of MDT happens.

Figure 27 provides a novel and supportive tool for practitioners and teams in high-performance sport. Where Klein and Kahneman's work on intuitive expertise and dual systems theory respectively (Kahneman, 2011; Kahneman & Klein, 2009) investigate individual performance, the current body of work presented in this thesis explores individual and team performance in one framework. This creates a novel bridge between the individual expertise and how it is accessed as part of the team aligned to the problems practitioners in sport contend with.

Leaning on Page's work on cognitive diversity (Page, 2019) and Salas work on team performance (Salas et al., 2008; Salas et al., 2018; Salas, Rosen, et al., 2010), the Practitioner and MDT lens (Figure 27) on problem-solving aligns and draws together existing research to the context of practitioners working in high-performance sport, something that has not been explored and researched until now. The framework (Figure 27) may be used to purposefully and consciously check how individuals and the team are operating and provides a novel stimulus for appraising problem-solving capability. The framework may further be used within the team or by leaders of the team to ensure that problem-solving is central to the function of a team.
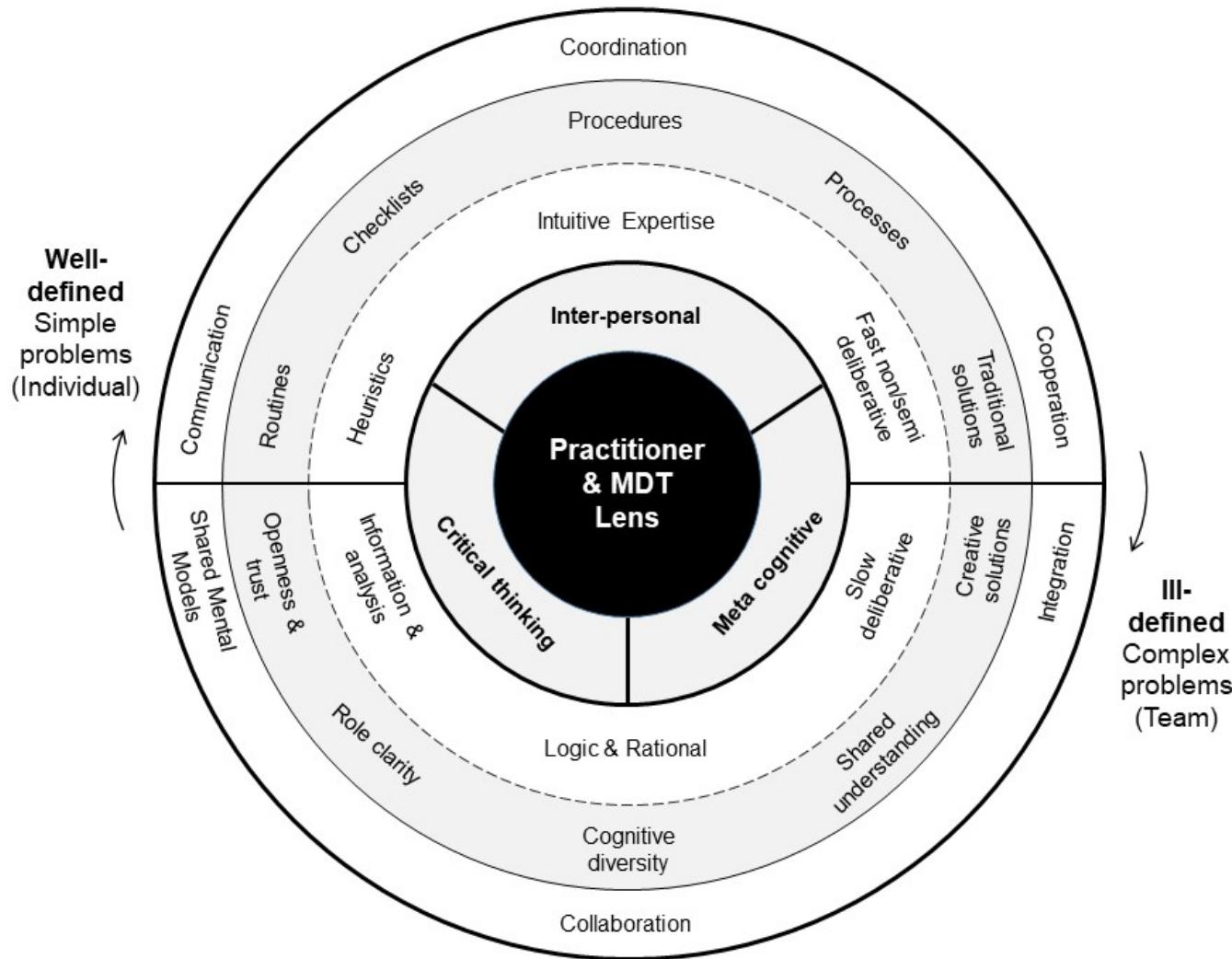
Figure 27: Problem-solving through the practitioner and MDT lens.

8.4.1 Problem-solving through the practitioner and MDT lens – Figure Overview

Figure 27 presents a structured framework for problem-solving in sports organisations, specifically through the Practitioner and MDT Lens. It categorises different problem types and the corresponding approaches and skills needed to address them, based on the nature of the problem (well-defined or ill-defined) and whether the problem-solving involves individual or team-based solutions.

8.4.2 Structure of the Practitioner and MDT Lens – Figure 27

Core: Practitioner and MDT Lens:

At the core of the framework, three key skills are identified as critical for effective problem-solving in a multidisciplinary sports team (see Chapter 7.3):

- Critical Thinking: The ability to evaluate, analyse, and apply logical reasoning when addressing challenges.
- Meta-Cognition: Reflecting on one's thought processes and adapting strategies, when necessary, especially important for practitioners working within the challenging high-performance environments.
- Interpersonal Skills: Effective communication, trust, and collaboration are essential for aligning teams and fostering productive problem-solving environments.

Second Ring: Intuitive Expertise vs. Logic and Rational Approaches (see Chapter 3):

This ring is split into two sections, highlighting the different approaches depending on the nature of the problem:

- Intuitive Expertise (Top): This approach is most suitable for well-defined, simple problems, which often require faster, non-conscious decision-making based on experience, routines, and expertise. Practitioners can rely on heuristics, checklists, and established procedures to solve these problems efficiently.
- Logic and Rational (bottom): For ill-defined, complex problems, a more deliberate and rational approach is necessary. These problems involve uncertainty and require thorough information analysis, cognitive diversity (i.e. multiple perspectives), and slower, more reflective thinking.

Outer Ring: Approaches to Individual vs. Team Solutions:

The outer ring splits into two contrasting approaches based on whether the solution involves an individual or a team:

- Individual-Oriented Solutions (Top): For well-defined, simpler problems, individual problem-solving strategies such as communication, routines, and heuristics (fast, experience-driven processes) are more appropriate. These are problems that can be

addressed by single practitioners or individuals working independently, using traditional methods.

- Team-Oriented Solutions (Bottom): For ill-defined, complex problems, solutions must be team-based. This involves coordination, collaboration, and cooperation among various members of the multidisciplinary team (MDT). Shared understanding, role clarity, and cognitive diversity are key to integrating different perspectives and arriving at a comprehensive solution.

Gradients between Problem Types:

- Well-Defined, Simple Problems: Depicted in the top half of the Figure, these problems are more individual in nature and can be solved using intuitive expertise. Established practices such as routines, heuristics, and fast decision-making processes (non-deliberative) help resolve these problems effectively.
- Ill-Defined, Complex Problems: Located in the bottom half of the Figure, these problems are more complex and team oriented. They require slow, deliberate thinking and cooperation between various members of the MDT. Traditional solutions are often not enough; instead, teams must use creative problem-solving, integration, and cognitive diversity to navigate ambiguity and complexity.

Utility of the Framework for Problem-Solving in Sport:

This framework provides a structured approach to problem-solving in high-performance sporting environments, enabling practitioners and teams to tackle both simple and complex challenges effectively:

- Skill Identification: By emphasising the core skills of critical thinking, meta-cognition, and interpersonal communication, this framework helps MDTs understand the key competencies required to solve problems in high-performance sports settings. Developing these skills ensures that teams are prepared for both routine and complex issues.
- Adapting Problem-Solving Approaches: The framework provides clear guidance on when to use intuitive expertise (for simple, well-defined problems) and when to employ logic and rational processes (for ill-defined, complex problems). This helps teams and practitioners tailor their approaches based on the type of problem they are facing, increasing their effectiveness.
- Balancing Individual vs. Team Solutions: The distinction between individual and team-based solutions is particularly useful in sport, where some issues can be resolved independently while others require multidisciplinary collaboration. The framework encourages MDTs to collaborate when needed and to leverage individual expertise for more straightforward problems.
- Promoting Cognitive Diversity and Shared Understanding: For complex problems, the framework emphasises the need for cognitive diversity, where different team members contribute their unique expertise. This ensures that solutions are well-rounded, creative, and effective in dealing with the ambiguity and complexity of high-performance sport.

- Dynamic and Adaptive Problem-Solving: The framework encourages flexibility in problem-solving approaches, allowing teams to quickly switch between fast, intuitive decision-making for simple issues and deliberate, rational processes for more complex problems. This dynamic adaptability is essential in fast-paced, high-stakes sporting environments.

The lens presented in Figure 27 provides an actionable approach for sports organisations and MDTs to solve problems effectively. It allows teams to categorise problems by complexity and choose the appropriate strategy (individual vs. team, intuitive vs. rational) while fostering the critical thinking, meta-cognitive, and interpersonal skills necessary for success in sport.

8.5 Problem-solving through the lens of leadership

In Chapter 4 the practitioners that were eligible to take part in the study identified effective leadership and positive team dynamics as critical to effective MDT performance (King et al., 2024b). This finding is not novel and well supported by literature (Stewart et al., 2024a). What is less known is how MDTs in high-performance sport attend to problems, generate and apply solutions to them and assess whether they are effective. In Chapters 3, 4 and 5 it was established that problems are somewhat nebulous, practitioners report working with different types of problems as individuals and yet both practitioners and leaders acknowledge a lack of ability to discriminate between problem-solving and decision-making or clearly articulate their processes to attending to either (King et al., 2024b; King et al., 2025).

In some cases, practitioners actively push against the concept of problem-solving arguing a preference for working towards goals, outcomes or solutions (King et al., 2024b), all which suggest automated process or delivery towards pre-determined and defined outcomes whilst overlooking the problems they set out to solve. This aligns with how practitioners tend to operate opting for recipe like prescriptions and traditional 'tried and tested' solutions (King et al., 2024a). It sheds further light on the challenges that exist for practitioners working within an MDT approach where they must integrate and collaborate across disciplines without purposeful discrimination and delineation of work processes or the need for a collaborative approach.

Despite actively pushing against the term 'problem-solving' when explicitly asked, the term was commonly and frequently used across our practitioner focus groups and leadership semi-structured interviews (King et al., 2024b; King et al., 2025) implying a tacit unconscious use of the term. Leadership plays a critical role in supporting individuals and teams to problem-solve and perhaps underscores an even greater role and need for leaders to bring problem-solving to the forefront of the teams' mind. Placing problem-solving at the centre of the MDT approach (as discussed in Chapter 7.4) may reframe and repurpose a practitioner's skills and expertise within a collaborative team approach transcending some of the conflict and ambiguity that practitioners report (King et al., 2024b).

Leadership is generally well researched, with a significant body of evidence underpinning types and styles of leadership (Bonini et al., 2024; Burke et al., 2006), approaches to leadership

(Ferkins et al., 2018) and models of leadership (Peachey et al., 2015). Access to leaders in high performance sport for the purposes of research is relatively rare with little evidence supporting how and what they attend to when leading MDTs. Through the lens of problem-solving, which is central to this thesis, to our knowledge is very novel. Furthermore, there are many models 'of' leadership available however there is a noticeable gap in literature on high performance leaders of MDTs working in sport (Jowett, 2024).

Cushion et al. (2006) describe models 'of' coaching as descriptive observations of behaviour illuminating what coaches do, yet, not why. Using semi structured interviews and adopting a reflexive thematic approach, findings from Chapter 5 were able to draw upon our sample of leader's tacit knowledge casting light on how they leverage MDTs and why (King et al., 2025). This thesis has generated new insights into how leaders operate in high-performance sports contexts. These insights informed the development of Figures 13 and 14 (presented earlier in Chapter 5), which propose a model designed to support and enhance the performance problem-solving capabilities of MDTs for both current and aspiring leaders (King et al., 2025). The model may be a useful framework for organisations and leadership to assess their approach and methods whilst evaluating performance impact through a problem-solving methodology.

It is important to reinforce the finding from Chapter 4 that practitioners focus on athlete health and performance (King et al., 2024b) whilst (as presented in Chapter 5), leaders focus on performance and the performance of the team (King et al., 2025). Leaders can play a pivotal role in directing MDT resource to problem-solving. For this to be effective, they must orientate the team around problems (Figure 25 and 26), discriminating the problem type from approach and more challenging, putting purposeful deliberative process in place to rationalise the problem spaces the team are asked to focus on. Teasing out the need for MDT problem-solving versus delivery by individual practitioners via intuitive expertise requires a flexible and considered approach by the leader. Figures 25-27 enable leaders to underpin their problem-solving with a deliberate approach, the use of Figure 28, brings this to life through the experiences of current leaders through their applied practice.

Figure 28: Problem-solving through the lens of leadership.

8.5.1 Problem-solving through the lens of leadership – Figure Overview

The 'Leader Lens' Figure 28 has been developed in the context of high-performance sport and built through the RTA applied to the semi-structured interviews conducted with our high-performance leaders as described in Chapter 5 (King et al., 2025). This Figure may help leaders, such as coaches, managers, and performance directors, navigate the complex environment of high-performance sports by focusing on critical dimensions that shape team dynamics and performance outcomes. The top part emphasises people-orientated themes, such as building trust, fostering communication, and creating a supportive environment, while the bottom part focuses on context-orientated themes, like decision-making, risk management, problem-solving, and adaptability.

8.5.2 Structure of the Leader Lens – Figure 28

Core Focus:

- At the centre is the Leader Lens, representing the leadership perspective that integrates people and contextual factors to drive performance.

Key Domains:

The framework is divided into two main domains:

- People (Top Half): This focuses on the human and relational aspects of leadership, including building trust, communication, support, and psychological safety.
- Context (Bottom Half): This area emphasises the structural, operational, and environmental factors that influence team performance, such as systems, processes, and problem-solving mechanisms.

Interpersonal, System, and Structural Layers:

Surrounding the leader's perspective are the interpersonal (people), system, and structural complexities that leaders must manage.

- Interpersonal (Top, People Domain): Focuses on relationship-building and team cohesion.
- System (Bottom Left, Context Domain): Involves information analysis, decision-making, and risk management.
- Structural (Bottom Right, Context Domain): Deals with processes and systems that support performance, including diversity, integration, and performance evaluation mechanisms.

Themes and Dimensions:

Surrounding the lens are the themes or dimensions that leaders need to attend to in each domain:

People-Oriented Themes (Top):

- Set the Climate: Establishing psychological safety, fostering collaboration, and ensuring open communication.
- Fostering Environment: Creating space for creativity, modelling behaviours, and aligning the team's goals.
- Professional Intimacy: Building strong relationships, trust, and understanding within the team to enhance cohesion and support.

Context-Oriented Themes (Bottom):

- Good Judgement: Leaders must navigate uncertainty, analyse risks, and leverage their experience and intuition.
- Problem Solving: Encouraging diversity in thinking, integrating various ideas, and continuously reviewing and improving performance processes.
- Navigating Complexity: Leaders must be adaptable, adjusting strategies in response to challenges and dynamic environments.

Utility in High-performance Sport Settings:

This Figure serves as a practical guide for leaders in high-performance environments, where multiple dynamic factors affect success. The Leader Lens helps leaders:

- **Understand and Balance Complexity:** Leaders must handle the interpersonal dynamics within the team while managing the contextual challenges of the sport environment. This framework provides a holistic view of how to address both simultaneously.
- **Foster a High-Performance Culture:** By attending to the psychological safety, communication, and trust-building elements, leaders can cultivate a positive climate that enhances team performance.
- **Make Informed Decisions:** The system and structural components guide leaders in using data-driven information, evaluating risk, and making good judgment calls under pressure.
- **Enhance Problem-Solving Capabilities:** Continuous improvement through structured processes (such as Plan-Do-Review) and fostering an environment of diversity in thinking help teams innovate and re-imagine performance strategies.

In summary, 'Leader Lens' Figure provides a robust map for addressing both people-centred and context-driven challenges in high-performance sports, supporting leaders in cultivating high-performing teams and optimising results in a complex, competitive environment.

Table 12: Breakdown of the Problem-Solving Framework Components[16]

Framework Figure	Content within each lens	Key Supporting References	Thesis Reference
Figure 25: Defining the Problem Space	**Problem Types:** *Ambiguous* – Ill-defined, complex, wicked problem *Clear* – Well-defined, simple, tame problems *Visibility* – Overt and direct problems – Covert and intangible problems	(Alford & Head, 2017; Childs & McLeod, 2013; Edmondson, 2012; Fiore et al., 2017; Gillette, 2011; Head, 2022; Head & Alford, 2015; King et al., 2024a; Kitchner, 1983; Nokes et al., 2009; Pitt et al., 2020; Schraw et al., 1995)	Chapter 2.4 Chapter 3.2.3 Chapter 4.2.4 Chapter 4.2.5 Chapter 5.2.4 Chapter 5.2.5 Chapter 7.2
	Areas where problems can exist: – Systems, structures, people, performance	(Balague et al., 2013; Burns & Collins, 2023; Head, 2022; Jowett, 2024; King et al., 2025; Otte et al., 2022; Reid et al., 2004; Rothwell et al., 2020; Stewart et al., 2024a, 2024b)	Chapter 3.2.4 Chapter 5.2.1 Chapter 5.2.4 Chapter 5.2.5
Figure 26: Problem type and approaches through different lenses	**Practitioner Lens:** – Intuitive expertise, Logic and rational	(D. Collins et al., 2016; Kahneman, 2011; Kahneman & Klein, 2009; King et al., 2024a; Klein, 1993, 1997, 2004; Salas, Rosen, et al., 2010)	Chapter 2.4.1 Chapter 3.2.1 Chapter 3.2.4 Chapter 3.2.5
	MDT Lens: – Role clarity; Shared understanding; Psychological safety; Cognitive diversity; Context; Adaptability	(Alfano & Collins, 2021; Burns & Collins, 2023; Hong & Page, 2004; King et al., 2024b; Page, 2019; Stewart et al., 2024b)	Chapter 4.2.1 Chapter 4.2.4
	Leadership & Organisational Lens:	(Edmondson, 2012; Edmondson & Bransby, 2023; Head & Alford, 2015; King et al., 2024a; King et al., 2024b; King et al., 2025)	Chapter 5.2.4

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[16] *This table presents a detailed breakdown of the key figures (25, 26, 27, and 28) that constitute the problem-solving framework. It outlines their individual components, relevant supporting references, and links to specific sections within the thesis, illustrating how the framework has been developed and contextualised throughout the study.*

	– Set the climate; Professional intimacy; Fostering environments; Good judgement; Navigating complexity; Performance problem-solving		
	Influencing Factors: Planning and purpose; Systems and structures	(Balague et al., 2013; Burns & Collins, 2023; King et al., 2025; Pitt et al., 2020; Stewart et al., 2024a)	Chapter 5 Chapter 5.2.4 Chapter 5.2.5 Chapter 7.4
Figure 27: Problem-solving through the practitioner and MDT lens.	**Practitioner T-Skills:** – Inter-personal, Meta-cognitive, Critical thinking	(L. Collins et al., 2016; DeChurch & Mesmer-Magnus, 2010; King et al., 2024b; King et al., 2025)	Chapter 4.2.3 Chapter 5.2.3 Chapter 7.3
	Well-defined simple problems (individual): – Heuristics, Intuitive expertise, fast non/semi deliberative	(Gigerenzer & Gaissmaier, 2011; Kahneman & Klein, 2009; King et al., 2024a; Lyle, 2010; Lyle & Muir, 2020; Raab & Gigerenzer, 2015)	Chapter 3.2.3 Chapter 3.2.4
	Approach: – Routines, checklists, procedures, processes, traditional solutions	(Hales & Pronovost, 2006; King et al., 2024a; Page, 2019)	Chapter 3.2.3 Chapter 3.2.4 Chapter 3.2.5
	Requirement: – Communication, coordination, cooperation	(Salas et al., 2008; Salas et al., 2018; Salcinovic et al., 2022)	Chapter 7.2
	Ill-defined complex problems (Team): – Information and analysis, Logic and rational, Slow deliberative	(Kahneman, 2011; Kahneman & Klein, 2009; King et al., 2024a; King et al., 2025; Lyle, 2010; Lyle & Cushion, 2010; Lyle & Muir, 2020)	Chapter 3.2.2 Chapter 5.2.4 Chapter 7.2 Chapter 7.4
	Approach: – Openness and trust, role clarity, cognitive diversity, shared understanding, creative solutions	(Alfano & Collins, 2021; Alfano & Collins, 2023; Burns & Collins, 2023; King et al., 2025; Reid et al., 2004; Stewart et al., 2024b)	Chapter 4.2.3 Chapter 4.2.4 Chapter 5.2.3 Chapter 5.2.4 Chapter 7.2
	Requirement: – Shared mental models, collaboration, integration	(Alfano & Collins, 2021; Ashford et al., 2023; Burns & Collins, 2023; Burns et al., 2024; King et al., 2024b; Stewart et al., 2024a)	Chapter 2 Chapter 4.2.2 Chapter 4.2.3 Chapter 7.3

Figure 28: Problem-solving through the lens of leadership	**Complexity type:** – Inter-personal, system, structural complexity	(Alford & Head, 2017; Balague et al., 2013; Bowes & Jones, 2006; Head, 2022; King et al., 2025; Pol et al., 2020; Rijpma, 2019; Vaughan et al., 2019)	Chapter 5.2.2 Chapter 5.2.4 Chapter 5.2.5

	People Domain:
	
	Set the climate
	  – Sharing and exchange, communication and collaboration, psychological safety
	Professional intimacy
	  – Empowerment and support, understanding and valuing, trust and relationships
	Fostering environments
	  – Create space and time, Model behaviours, Clarity and alignment
		(King et al., 2024b; King et al., 2025)	Chapter 4.2.4
			Chapter 5.2.4
			Chapter 7.4

	Context Domain:
	
	Good Judgement
	  – Information and analysis, certainty and risk, experience and intuition
	Navigating complexity
	  – It depends and shades of grey, Reactive and adaptable, Structure, systems and processes
	Problem-Solving
	  – Plan-Do-Review, Re-imagining performance, diversity and integration
		(King et al., 2024a; King et al., 2024b; King et al., 2025)	Chapter 3.2.4
			Chapter 4.2.4
			Chapter 5.2.4
			Chapter 7.4

8.6 Professional Contribution

The Problem-Solving Framework presented in Figures 25–28 has been developed throughout this thesis and is summarised in Table 12. This framework and its corresponding table provide a novel and practical contribution to the existing knowledge base, offering insights into how individual practitioners, inter-professional MDTs, and their leaders leverage diverse skills, expertise, and cognitive diversity to address performance challenges in high-performance contexts.

The thesis question sought to clarify terms often used tacitly and imprecisely in high-performance sport such as multi or inter-disciplinary teams, performance problem-solving, performance solutions, and collaboration. Based on novel findings, these terms are frequently assumed to be well understood by practitioners, coaches, and leaders, yet until now, their precise meanings and practical applications have not been thoroughly investigated.

Additionally, a growing body of literature, along with this research, has highlighted confusion surrounding how individuals' function within an MDT and, more importantly, why MDT collaboration is essential. These assumptions likely contribute to the conflict, ambiguity, and inefficiencies observed in high-performance sport. This thesis, therefore, establishes clearer definitions and a richer vocabulary for high-performance environments, offering sports organisations and leaders a solid foundation for building highly effective inter-professional MDTs. Through the thesis it has been possible to identify some key learnings which are essential to MDT practitioners and how they work.

Decision-Making and Problem-Solving

Critical thinking skills such as problem-solving and decision-making are often taken for granted, yet these terms remain abstract and difficult to articulate in practice. The research in the present thesis highlights the need for practitioners to develop metacognitive skills that enable them to discern when to apply decision-making versus problem-solving strategies. By fostering cognitive flexibility, practitioners can better adapt their approach based on contextual demands.

Intuitive Expertise vs. Rationalising

Understanding the distinction between problem types (ill- or well-defined) and decision styles (fast or slow) allows practitioners to determine when to rely on automation strategies (e.g., procedures, protocols, checklists) versus when a more rationalised, analytical approach is required. For complex, ill-defined problems, it is essential to consider whether an individual's expertise suffices or if a diverse MDT is needed for a more effective and timely solution.

Communication vs. Collaboration

For straightforward, well-defined problems, individual expertise within a specific discipline may be sufficient. In such cases, clear communication, coordination, and cooperation among team members should take precedence over collaboration. Collaboration, defined as 'a team of individuals working together to overcome a shared problem,' should not be applied indiscriminately. Misuse of collaboration for simple problems may contribute to the conflict and inefficiencies highlighted in Study 2. Effective leadership must ensure that collaboration

is used strategically, with clear direction, purpose, and objectives, rather than as a default approach.

Accessing Cognitive Diversity

Inter-professional teams can function as either loosely connected groups of discipline-specific practitioners or as highly integrated teams with interdependent tasks. It is the leader's role to determine which structure best fits the context. To leverage expertise within an MDT, it is crucial that knowledge is actively shared. An individual's cognitive repertoire (heuristics, perspectives, mental models) can only be utilised through effective communication. Leaders must create supportive, psychologically safe environments that foster relationship development, role clarity, and a shared understanding of the task requirements. Chapter 7.4 outlines how design thinking can serve as a valuable tool for harnessing MDT expertise in complex problem-solving.

Interpersonal Skills

While practitioners often prioritise technical expertise, this research underscores the critical role of interpersonal skills in effective MDT collaboration. This presents a challenge: individual practitioners cultivate deep domain-specific knowledge, yet MDT practitioners must make this knowledge accessible and valuable to the broader team. The T-Skills model introduced in Chapter 7.3 provides a framework for emphasising cross-disciplinary competencies and improving inter-team communication. Meta-cognitive, critical-thinking, and interpersonal skills are essential for MDT effectiveness, and their development should be integrated into academic, vocational, and professional training. As long as these skills continue to be learned 'on the job' rather than through structured development, the ability to fully harness diverse expertise will remain hindered by disruptive team dynamics. Future efforts should focus on creating opportunities for both developing and experienced practitioners to enhance these skills and apply them in practice.

Problem-solving is an integral part of daily professional practice, both consciously and unconsciously. It is hoped that the Problem-Solving Framework presented in this thesis serves as a valuable resource for individual practitioners, MDTs, leaders, and sports organisations. By effectively leveraging the expertise and cognitive diversity within MDTs, in which organisations invest significantly, high-performance sport can continue to address complex performance challenges with greater structure and purpose.

8.7 Limitations

This section outlines the limitations of the research and provides critical reflections on the overall learning journey. The limitations of each peer-reviewed study have been discussed in their respective chapters (see Chapters 3.2.5, 4.2.5, and 5.2.5) and are further summarised below.

Methodological Limitations

Study 1:

Study 1 utilised Likert scales to assess the strength of perceptions regarding how MDT practitioners approach their work, with results displayed using dual-axis heat mapping. The survey was developed based on relevant literature on problem-solving, decision-making, and expertise. Effort was made to ensure clarity in the survey statements, and participants were instructed to adopt a broad perspective rather than focusing on specific examples. This approach effectively captured the sentiments of a large number of practitioners, allowing for general observations about their problem-solving styles and decision-making approaches.

While Likert scales are a valuable tool for measuring perceptions, they are susceptible to acquiescence bias, where participants may select responses without fully considering each statement, particularly when attempting to complete the survey quickly. To mitigate this, the survey incorporated both positively and negatively framed statements to encourage deeper reflection. Additionally, it was structured into sections to allow respondents to pause and refresh before proceeding, and statements were randomised across the 71 survey items. A further refinement of the survey design, including additional piloting and a direct enquiry into practitioners' problem-solving and decision-making styles, could have strengthened the study.

The dual-axis heat mapping and the doublet and triplet statement analysis introduced a novel method for visualising aggregated Likert scale responses. While this visualisation technique effectively highlighted patterns and the cognitive flexibility required in MDT work, it is important to note that these heat maps do not indicate correlations between statements. Their primary purpose was to provide insight into practitioners' work patterns, which the method successfully achieved. In retrospect, presenting findings based on individual and grouped statements (refer to Appendix D for examples) within and across the continuums could have enriched the discussion. Additionally, using the full 5-point Likert scale in the heat maps, rather than aggregating responses into broader categories, would have allowed for greater granularity.

The study's participant pool was diverse, representing a range of disciplines within high-performance sport. The sample however was skewed towards performance-related practitioners, and gender representation was not specifically analysed.

Studies 2 and 3:

The primary goal of Study 1 was to understand how individual practitioners think about and approach their work. In contrast, Studies 2 and 3 explored how MDT practitioners collaborate to solve complex problems, requiring them to move beyond their individual styles and work within a team setting. Given the abstract nature of critical thinking in team contexts, a pragmatic research approach was necessary. Focus groups and semi-structured interviews allowed for an in-depth exploration of practitioners' and leaders' perceptions, experiences, and real-world applications of problem-solving and decision-making. Reflexive thematic analysis (RTA) was chosen as an appropriate method for interpreting these qualitative data.

The interview and focus group schedules were designed to align with the overarching research questions. In hindsight, a more focused schedule could have enabled participants to explore specific aspects in greater depth. While efforts were made to craft broad, open-ended questions

that allowed participants to guide the discussion, some struggled to initiate responses, occasionally requiring clarification. Nonetheless, once discussions began, they flowed naturally. One limitation is that, in avoiding leading questions, certain important themes may have been overlooked.

A key consideration in qualitative research is the balance between researcher subjectivity and analytical rigor. While a post-positivist approach may question the qualitative methods used, the insights generated, and the framework developed through this research would not have been achievable using purely quantitative techniques. The lead researcher's experience in high-performance sport provided valuable contextual knowledge and introduced the potential for bias. To counter this, reflective journaling, iterative theme refinement, and supervisory review of transcripts and thematic maps ensured that the analysis remained grounded in the data. While these measures helped mitigate bias, further analysis may have uncovered additional insights.

A notable limitation of Studies 2 and 3 is gender representation. Although the research did not specifically aim to examine gender differences, a higher proportion of female participants would have improved representativeness. Of the 28 practitioners in Study 2, eight were female (28%), and of the eight leaders in Study 3, one was female (12%), leading to an overall female representation of 25%. While these figures reflect the voluntary recruitment process, future research could examine whether this distribution aligns with the broader demographics of practitioners in high-performance sport.

Another challenge was synthesising the extensive qualitative data across Studies 2 and 3 to create a coherent narrative. This thesis explored decision-making and problem-solving from the perspectives of individuals, teams, and leaders/organisations, requiring a broad horizontal integration of findings rather than an in-depth examination of a single element. While a narrower focus on one aspect of problem-solving could have been pursued, the researcher believes this approach would not have sufficiently addressed the thesis question or led to the development of the problem-solving framework.

Research Question Considerations

The research question was deliberately broad to capture the complexities of decision-making and problem-solving in MDTs. One of the most striking findings was that these concepts are often used interchangeably and unconsciously by practitioners and leaders, despite their distinct cognitive processes. While there is a strong theoretical foundation for both decision-making and problem-solving, in practice, they are frequently entangled and applied without deliberate awareness.

On reflection, narrowing the research question to focus explicitly on how MDTs solve problems might have led to a different research design and outcomes. Future research could explore problem-solving in MDTs within specific sporting contexts or focus on problem types. That said, the broad approach taken in this thesis provided a more holistic view, capturing decision-making and problem-solving at micro and macro levels and highlighting the unintended complexities that arise within systems.

Study 1 made an initial attempt to differentiate decision-making from problem-solving, while Study 2 investigated how these cognitive skills manifest in MDT collaboration. Study 3 extended this by examining how leaders leverage MDTs to solve complex problems (King et al., 2025). The distinction between decision-making and problem-solving within MDT contexts in high-performance sport remains underexplored, and this thesis contributes to an emerging body of literature that identifies avenues for further research.

Contextual Considerations

The body of research in the current thesis included participants from various sports, organisations, and countries, providing a diverse sample that strengthens the generalisability of the findings. It may be valuable to replicate this research within specific sports or organisations, such as examining differences between clubs within the Football Association (FA) Premier League. Conducting comparative studies across sports and national contexts could reveal variations in problem-solving and decision-making approaches, further enriching the field of MDT research.

Broad approach to answering the research question

Completing the *Scientific Evolution of Working Practice* module was instrumental in formulating the initial thesis research question (see Figure 1): *The MDT practitioner in elite sport – Skilled 'procedural' doers or cognitive 'knowledge' problem solvers?* While Study 1 directly addresses this question, it served as a further catalyst for the broader evolution of this research.

The early literature review predominantly focused on decision-making science, reflecting the initial direction of the learning journey. However, as the thesis progressed, the studies and their findings guided the next phases of enquiry, shaping the research trajectory. In retrospect, a significant takeaway from this journey has been the importance of crafting precise research questions and systematically deconstructing them to arrive at meaningful answers.

One of the most valuable aspects of this experience has been developing expertise in research processes, methodologies, and the execution, presentation, and evaluation of findings. A key limitation of this thesis, however, lies in the researcher's initial lack of awareness regarding research design, methodology, and execution, an acknowledgment that serves as both a critical reflection and a learning opportunity. If given the chance to undertake this research again or supervise a future doctoral candidate, the clarity, precision, and purpose of each stage would be significantly enhanced, ultimately leading to far superior outcomes. This realisation underscores the potential for this thesis to have been a much stronger contribution to the field.

Summary

While this research has made significant contributions to understanding problem-solving and decision-making in MDTs, it further highlights areas for improvement and further exploration. Methodological refinements, greater gender representation, and more focused research questions may enhance future studies. Nonetheless, the insights generated provide a

foundation for continued investigation into the complexities of MDT collaboration in high-performance sport.

8.8 Future Research Considerations

Building on the findings of this thesis, several areas for further research and development have been identified to enhance the understanding and application of problem-solving within high-performance sport.

Advancing the Practitioner Survey and Data Collection

Future research should focus on refining and expanding the individual practitioner survey. Deploying it across different disciplines or sporting organisations (for example, a major La Liga club has expressed interest in Study 1 (King et al., 2024a) and would like to participate in a study using its methodology) may consequently facilitate the development of a more comprehensive dataset. This data may then be used to align the continuums identified in this thesis with the technical expertise and problem-solving approaches practitioners employ in service delivery. A robust dataset depicting the strength of practitioner perceptions, aligned with applied practice and the critical thinking skills required, would be invaluable in:

- Developing mental models that support effective problem-solving in complex environments.

- Enhancing scenario-based and problem-based learning opportunities to bridge theory and practice.

- Informing targeted training that explicitly links cognitive skills with applied performance contexts.

Observational Studies and Expert MDT Analysis

Complementing the survey data, observational studies, alongside interviews and focus groups with expert MDTs, should be conducted to enhance the findings of Study 2 (King et al., 2024b). The thematic map that outlines how practitioners' function within MDTs could be further validated and adopted as a framework for assessing the operational realities of sporting organisations, whether they align with the utopian ideal of interdisciplinary collaboration, or the more fragmented reality observed in practice. Consequently, it is suggested that future research should aim to explore;

- How MDTs problem-solve, develop shared mental models, and leverage collective expertise.

- The processes by which MDTs navigate challenges, resolve inter-professional conflicts, and integrate their knowledge.

- The role of leadership in fostering an environment where MDTs can effectively collaborate and contribute to decision-making.

Developing an Organisational Inventory and Leadership Insights

To further enhance the application of this research, an organisational inventory based on the thematic map presented in Study 3 (King et al., 2025) (under review) and developed in Figure 28 should be developed. This inventory could serve as a practical tool for leaders to conduct observational studies and environmental evaluations, helping to assess how modern-day sporting leaders create effective team climates.

Key areas for exploration may include:

- How leaders navigate complex systems and uncertainty in high-performance sport.

- The role of data and insight in shaping leadership confidence and decision-making.

- Strategies for balancing structure and flexibility to enhance problem-solving capacity within MDTs.

Developing and Embedding Practitioner T-Skills

A critical next step in high-performance sport is the structured development of T-Skills among practitioners. While the importance of cross-functional, inter-professional collaboration is widely recognised, explicit training in horizontal skills (metacognition, critical thinking, and interpersonal skills) remains a gap. Future research should therefore seek to explore:

- Identify best practices for integrating T-Skills into practitioner education.

- Develop real-world training modules that situate these skills in applied practice.

- Examine the impact of structured T-Skills development on MDT effectiveness and interdisciplinary collaboration.

Training in the Problem-Solving Frameworks

The problem-solving framework (Figure's 25-28 on pp. 146-160) proposed in this thesis provides a structured approach for practitioners, teams, and leaders to engage in deliberate and rational problem-solving. Further work is required however, to integrate this framework into professional training programmes.

A future training program should consider:

- Shifting the emphasis from technical expertise alone to collaborative problem-solving.

- Highlight how problem-solving methodologies can mitigate interpersonal conflict within MDTs.

- Equip leaders with tools to leverage cognitive diversity and drive innovation in high-performance sport.

Summary

The suggested directions provide a roadmap for future research, emphasising the need for structured, evidence-based approaches to enhancing MDT collaboration, practitioner development, and leadership effectiveness in high-performance sport. By addressing these areas, the field can continue to evolve, ensuring that practitioners and organisations are equipped to meet the complex challenges of modern sport.

8.9 Summary and Conclusions

This thesis set out to critically examine the role of MDTs in high-performance sport, with a specific focus on their problem-solving and decision-making processes and approaches. Through a 'pragmatic' constructivist, qualitative methodology, the research explored how individual practitioners, MDTs, and high-performance leaders conceptualise and execute problem-solving within high-performance environments. The findings contribute to the growing discourse and contemporary body of evidence on interdisciplinary collaboration, cognitive diversity, and applied decision-making frameworks in performance sport contexts within high-performance sport.

Key Summaries

1. Practitioner Problem-Solving: A Continuum of Approaches

The initial study (King et al., 2024a) identified a continuum of problem-solving approaches, ranging from routine, intuitive decision-making to deliberate, innovative problem-solving. Despite an increasing emphasis on critical thinking and creativity in high-performance sport, practitioners often default to discipline-specific, pre-established solutions, rather than engaging in genuinely interdisciplinary problem-solving. These findings acknowledge a gap between formal education or training and the applied demands of high-performance sport, suggesting the need for greater emphasis on cognitive flexibility and metacognition in practitioner development.

2. Theoretical vs. Applied Collaboration in MDTs

While MDTs are theoretically structured to facilitate collaboration, in practice, many function as loosely connected groups of specialists rather than integrated problem-solving units. The thesis overall identified key barriers to collaboration (King et al., 2024b); (1) Ambiguity in roles and expertise, leading to inefficiencies in team functioning (2) Siloed thinking and professional territoriality, which limit interdisciplinary integration and (3), The absence of structured problem-solving frameworks, reducing the effectiveness of MDT interventions. These findings underscore the necessity for deliberate, structured approaches to collaboration, beyond default cooperative interactions.

3. Leadership and the Structuring of MDT Problem-Solving

The final study (King et al., 2025) revealed high-performance sport as a complex system and flagged a disconnection between leadership expectations and MDT functioning, where leaders struggle to define and implement effective team-based decision-making and problem-solving strategies. While cognitive diversity has been identified as a crucial factor in complex problem-solving, leaders lack clear frameworks to leverage this diversity effectively. The study advocates for the integration of structured problem-solving methodologies, such as design thinking, to enhance MDT effectiveness and innovation in high-performance sport.

4. Implications for Theory and Practice

This thesis advances the theoretical understanding of MDTs in high-performance sport, contributing to literature on multi and interdisciplinary team dynamics, problem-solving frameworks, and applied cognition. From an applied perspective, the findings support the development of 'T-Skills' (meta-cognitive, interpersonal, and critical thinking skills) as essential components of MDT training and professional development. The study suggests a reframing of MDTs as active, problem-solving entities rather than passive collections of expertise, reinforcing the importance of structured collaboration, leadership clarity, and integrated decision-making within a multiple lens 'problem-solving' framework.

Conclusion

The body of work presented in this thesis consists of three peer-reviewed studies (King et al., 2024a; King et al., 2024b; King et al., 2025), and three critical perspectives derived from the primary research (Chapter 7.2, 7.3 and 7.4) owing to a final problem-solving framework (Chapter 8), all of which have contributed to the understanding of how individuals, as part of teams and leaders of high-performance MDTs deliver support, make decisions and problem-solve within high performance contexts.

This research collectively challenges assumptions about the effectiveness of MDTs, demonstrating that collaboration is not a panacea and should be used judiciously in high-performance sport. Collaboration is not inherently beneficial unless deliberately structured around problems that truly necessitate it. When this is not the case, collaboration is risky, leading to ambiguity, confusion and conflict. The findings of the thesis contribute to the broader academic discourse on team-based problem-solving and decision-making, emphasising the role of cognitive diversity, interdisciplinary integration and leadership structure. By bridging the gap between theoretical models and applied practice, this thesis provides a conceptual and practical foundation for enhancing MDT performance in high-performance sport contexts. Finally, the findings from the research presented in this thesis has successfully underpinned some of the tacitly used discourse in high performance sport of collaboration, problem-solving and performance solutions with tangible frameworks that can be considered in practice.

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Appendices

APPENDIX A: Ethics Approval Study 1

University of Central Lancashire
UCLan

University of Central Lancashire
Preston PR1 2HE
01772 201201
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12 October 2022

David Rhodes / Ryan King
School of Sport and Health Sciences
University of Central Lancashire

Dear David and Ryan,

Re: BAHSS2 Ethics Panel Application
Unique Reference Number: BAHSS2 0385

The BAHSS2 Ethics Review Panel has granted approval of your proposal application, 'Skilled doers or cognitive 'knowledge' problem solvers – the multi-disciplinary (MDT) practitioner in elite sport'.

Approval is granted up to the end of project date*.

It is your responsibility to ensure that

- the project is carried out in line with the information provided in the forms you have submitted
- you regularly re-consider the ethical issues that may be raised in generating and analysing your data
- any proposed amendments/changes to the project are raised with, and approved, by Committee
- you notify ethicsinfo@uclan.ac.uk if the end date changes or the project does not start
- serious adverse events that occur from the project are reported to Panel
- a closure report is submitted to complete the ethics governance procedures (Existing paperwork can be used for this purposes e.g. funder's end of grant report; abstract for student award or NRES final report. If none of these are available use e-Ethics Closure Report Proforma).

Yours sincerely

Daniel Bürkle
Deputy Vice-Chair
BAHSS2 Ethics Panel

* for research degree students this will be the final lapse date
NB - Ethical approval is contingent on any health and safety checklists having been completed, and necessary approvals gained.

APPENDIX B: Ethics Approval Study 2 and 3

University of Central Lancashire
UCLan

26 May 2023

David Rhodes / Ryan King
School of Sport and Health Sciences
University of Central Lancashire

Dear David / Ryan

Re: BAHSS Ethics Review Panel Application
Unique Reference Number: BAHSS2 0385 Study_2

The BAHSS Ethics Review Panel has granted approval of your proposal application 'Skilled doers or cognitive 'knowledge' problem solvers – the multi-disciplinary (MDT) practitioner in elite sport'. Approval is granted up to the end of project date. *

It is your responsibility to ensure that:
- the project is carried out in line with the information provided in the forms you have submitted
- you regularly re-consider the ethical issues that may be raised in generating and analysing your data
- any proposed amendments/changes to the project are raised with, and approved by, the Ethics Review Panel
- you notify EthicsInfo@uclan.ac.uk if the end date changes or the project does not start
- serious adverse events that occur from the project are reported to the Ethics Review Panel
- a closure report is submitted to complete the ethics governance procedures (existing paperwork can be used for this purpose e.g. funder's end of grant report; abstract for student award or NRES final report. If none of these are available, use the e-Ethics Closure Report pro forma).

Yours sincerely

Douglas Martin.

Douglas Martin
Vice-Chair
BAHSS Ethics Review Panel

* for research degree students this will be the final lapse date

NB - Ethical approval is contingent on any health and safety checklists having been completed and necessary approvals gained as a result.

Elite Practitioner: Multi-Disciplinary Teams Survey

A survey to better understand practitioners views on how they approach their work

A little bit of what this survey is all about...

This survey is open to **ANY** practitioner that works as part of a multi-disciplinary team in elite high-performance sport. In this survey we seek to understand aspects of how you work in your current context.

This research is being conducted by Doctoral candidate Ryan King, Principle researcher Dr Dave Rhodes and Dr. John Kiely. If you have any questions or concerns about this survey please contact Dr Dave Rhodes at drhodes2@uclan.ac.uk.

The survey includes some questions about you specifically and then statements which we would ask you to work through. The survey should take you **no more than 15 minutes to complete**.

On completion, you will be given the opportunity to download your responses. When completing the survey please attempt to think broadly about your role (zoom out) and try to refrain from thinking about specific examples (zoom in). We would like you to consider the statements through the lens of your usual 'day to day' delivery as part of the Multi-Disciplinary Team that you work in.

Can we ask that you answer honestly, try not to overthink your responses and go with what 'feels right'. Remember, try to stay 'zoomed out' and resist 'zooming in' to specific examples.

All submitted surveys are confidential and any publication of relevant findings will be completely anonymised.

Thank you for taking the time to participate in this survey.

This is the section where we tell you about consent and it is important because it is about your personal data.

Here we will check you are comfortable taking part and let you know how your data will be used.

Please read the participant 'consent form' prior to completing the survey and indicate that you consent to submitting your data for the purposes of the research:

https://msuclanac-my.sharepoint.com/:b:/g/personal/rking12_uclan_ac_uk/EQZzNBKXAPBMqqNqa9yDc0kBxjXUB6bLIQEo0RIYWazGCw?e=kmeiVL

For access to the detailed Participant Information Sheet please email rking12@uclan.ac.uk

By clicking yes below you indicate:

- You have read the consent form
- You voluntarily agree to participate
- You are at least 18 years or older

I consent to take part in this survey and am aware that if I have provided an email address, I can remove my consent at any time up until the survey is closed (8 weeks from the survey opening). In removing my consent, both my responses and email address will be deleted and not included in the analysis.

We would love to hear a little bit about you and where you work.

For the purposes of this research, we simply want to get a sense of the diversity across Multi-Disciplinary Teams.

Thank you...

2. What age bracket do you fall within

<24

25-34

35-44

45-54

55-64

>65

3. What is your sex

Male

Female

Prefer not to say

4. What is your Ethnic Origin

Indian

Pakistan

Bangladeshi

Chinese

Any other Asian background

Caribbean

African

Any other Black, Black British or Caribbean background

White and Black African

White and Black Caribbean

White and Asian

Any other multiple mixed or multiple ethnic backgrounds

English, Welsh, Scottish, Northern Irish, British

Irish

Gypsy or Irish Traveller

Roma

Any other white background

Arab

Any other ethnic group

5. What level of education have you obtained?

High School Certificates

Undergraduate Degree

Post Graduate Degree

Masters Degree

PhD

6. Do you have professional certificates or qualifications outside your academic obtainment?

Yes

No

7. What is your Discipline (if you perform multiple functions in your role please tick all appropriate disciplines)

Doctor

Head of Performance

Nutritionist

Sports Science

Sports Therapist

Strength and Conditioning

Performance Analysis

Performance Lifestyle

Performance Psychology

Physiotherapist

Head of Medical

Coach

Other

8. If you answered Head of Performance or Head of Medical above, how big is the Multi-Disciplinary Team that you oversee? If you are not a HoD - please move to the next question.

<2

<5

<7

<9

>10

9. Do you work in sport <u>in a professional capacity</u> as part of a Multi-Disciplinary Team?

for the purposes of this survey 'professional' means you work in paid 'full or part time capacity' for an organisation, institute, governing body or club that provides performance and/or medical services to 'elite' level athletes.

Yes

No

10. How many people work in your team or department?

<2

<5

<7

<9

>10

11. What is the main sport you currently work with?

Open box

12. What best describes the level that you currently work with? (Select one where you work as part of an MDT)

World Class Podium

World Class Potential

Talent Development

Senior/First Team

Academy

13. How many years have you been in your current role?

<1

1-2

2-3

3-4

4-5

>5

14. How many years of accrued experience do you have?

1-3

3-5

5-7

7-9

>10

OK, thanks for providing us with that information, it will really help with the analysis and follow up elements of the project. We are now ready to get stuck in.

You will now see 20 statements.

Rate how strongly you agree or disagree with each statement... It is that simple.

1: No! Strongly Disagree

2: I kind of disagree

3: I'm neutral

4: Moving towards agreeing

5: Yip! 100% Agree

15. When thinking about my 'day to day' delivery as part of the MDT to provide service:

1. Mu working day is made up of stable routines
2. I have a clear tasks that I execute on a adaily/weekly basis
3. I know what I am expected to do in my role
4. I know what to expect of other members of the MDT in their role
5. My skills and experience ensure that I am effective in my role
6. What I deliver is effective
7. I frequently have to find new solutions to be effective
8. I am free to do what I want in my role
9. I try new things even if I am not confident it will be effective
10. I make suggestions frequently that challenge our normal routines
11. I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
12. Our processes are well established
13. My delivery is measured objectively
14. I frequently do things that are different or untested
15. Routines and Processes are essential in this environment
16. I love thinking 'out of the box' and testing my ideas
17. I frequently embrace new technologies when delivering in my role
18. My skills are what what make me successful
19. I never know what's going to happen next in my working day
20. Evidence based Practice is less important than Practice based evidence

It was as easy as that! Well done!

In this section, it's the same - a simple rating but this time, only 10 statements.

Next section...

Remember - stayed zoomed out!

When 'problem solving' as part of the MDT to provide service:

21. The solution required when working with an athlete or team is usually obvious
22. I am confident I know what must be done to provide impactful solutions
23. I am frequently required to problem solve in my role
24. I usually have several solutions that will address the problems I work with
25. Processes and checklists are important in my role
26. I have seen most scenarios that I am faced with before and am confident I can do the right thing
27. My ability is what helps me to overcome the problems that I face in my role
28. I take time to establish what the problem is before addressing it
29. Addressing problems is done in a methodical and considered way
30. It is easy to identify problems in my role

You are flying now and I can see you have got the idea!

Another 10 statements in this section to rate. Remember, try not to think specifics, keep general and go with what you feel!

When making decisions as part of the MDT to provide service:

31. I frequently reason (weighing and rationalising) before making decisions
32. My decisions are informed through data that has been collected
33. I check my decision before moving to action
34. It is most important in my role that I work through well-crafted technical skills
35. I apply algorithms, logic and reasoning before acting in my role
36. I follow my Intuition 'going with my gut' when making decisions
37. I am expected to know the answers when I am asked questions
38. I unpack the solution once I recognise what is happening
39. Anticipation is important when performing my role
40. The course of action is usually clear and obvious
41. I am constantly having to react and think on my feet

You have past the halfway mark. - 2 sections to go.

Keep the energy levels up! 10 statements coming your way...

When using data as part of an MDT to provide service:

42. I use data to understand the impact of my work
43. Data drives my decision making
44. The data I have is the right data
45. I have a full understanding of what the data is telling me
46. I am confident that the data we collect is the data we need
47. I visualise the data to generate insight for the team
48. Generating data through various means enables me to make sense of my work
49. I predict what to do next based on the data I generate
50. I use data to forecast what is going to happen
51. I assess data objectively and it fully informs my decision making

Last section, we are on the home straight. The final 20 statements are a click away.

Be honest with how you feel but remember, try not to anchor on to specifics!

When working within the MDT:

52. I frequently meet team members to discuss our work
53. I effectively communicate with the rest of the team
54. I am clear on my goals and objectives
55. I am clear on other team members goals and objectives
56. I am safe to speak up
57. I take risks in my role
58. I have high levels of freedom
59. I am personally challenged in my role
60. I have time to create ideas
61. My ideas are supported
62. I must deal with conflict
63. I feel safe to speak my mind
64. Trust is high
65. I vigorously debate my point of view
66. I have fun
67. There is good humour in the team
68. I shape my skills and approach to work with others
69. I am accountable for the service that I provide
70. I feel well supported
71. I will speak up if I disagree

Nearly done!

Remember, this is an anonymous survey and we have no way of identifying you from the details you have provided.

Are you happy to be contacted for follow up interviews or learning opportunities? (If you click yes, you will be asked to submit an email address)

Y

N

If you are happy to be contacted please submit your email address below:

Open box

One final question (if you have the time)...

If we were to offer educational content to support how you work within a Multi-Disciplinary Team what would be your preferred learning style (you can tick as many as you like)

Virtual Interactive Meetings

On line 'pop up' 1-to-1 Meetings

Video Lectures

Info Graphics and readable materials

In person workshops (with the rest of your MDT)

In person workshops (With a variety of MDT's)

Thank you for taking the time to work through this survey.

You have just contributed to our understanding of how MDT practitioners work and what is perceived to be important!

We hope to follow up with some of you (if you provided an email address) to do some interviews and possibly some further tasks that will give even further insight into how teams work together.

Thanks again for your help and hopefully we will speak at some point soon.

Ryan

Grouped Statement Comparisons: *Creativity and Innovation*

Figure 1: Creativity and Innovation (x: Procedures y: Doing)
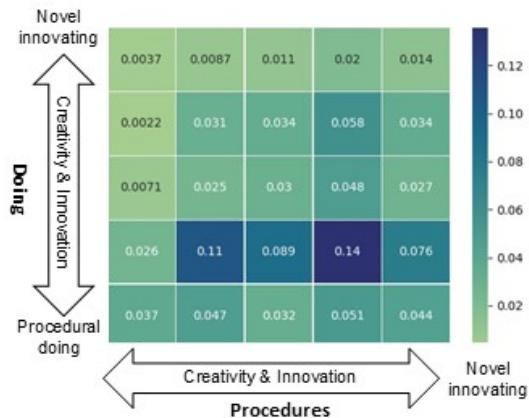
Creativity and Innovation

Doing Statements:
- Routines and Processes are essential in this environment
- I have clear tasks that I execute on a daily/weekly basis
- My working day/week is made up of stable routines
- Our processes are well established

Figure 2: Creativity and Innovation (x: Innovating y: Doing)
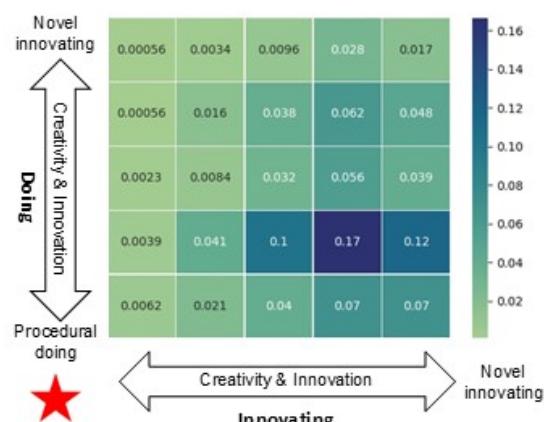
Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Figure 1: Creativity and Innovation (x: Freedom y: Doing)
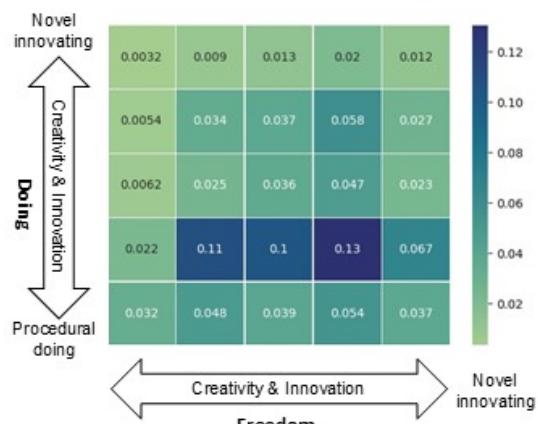
Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

Grouped Statement Comparisons: *Creativity and Innovation & Problem Solving*

Figure 4: Creativity and Innovation (x: Procedures)
Creativity and Innovation (y: Innovating)
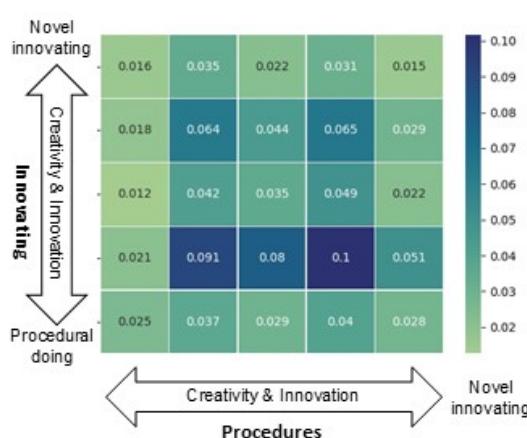
Figure 5: Creativity and Innovation (x: Freedom)
Creativity and Innovation (y: Innovating)
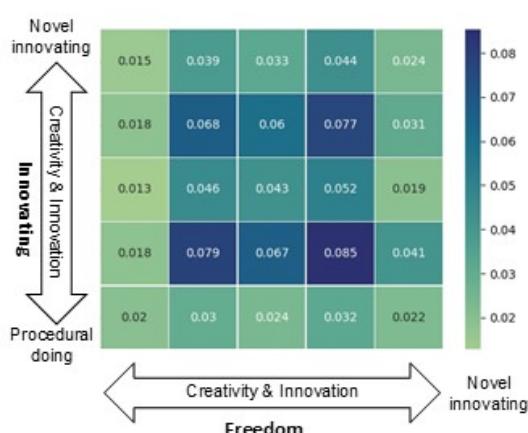
Figure 6: Problem Solving (x: Simple) Creativity and Innovation (y: Freedom)

Creativity and Innovation

Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

Problem Solving

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

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Figure 7: Problem Solving (x: Complex) Creativity and Innovation (y: Doing)

Creativity and Innovation

Doing Statements:
- Routines and Processes are essential in this environment
- I have clear tasks that I execute on a daily/weekly basis
- My working day/week is made up of stable routines
- Our processes are well established
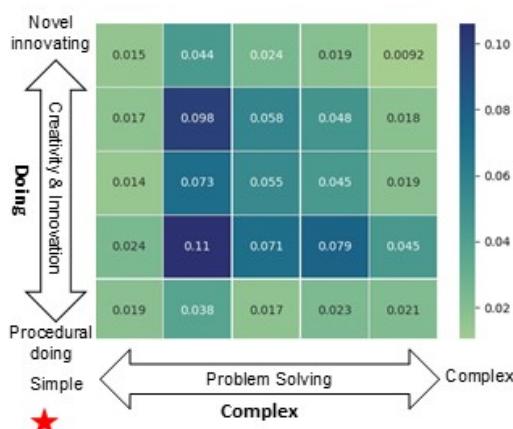
Figure 8: Problem Solving (x: Complex) Creativity and Innovation (y: Freedom)

Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day
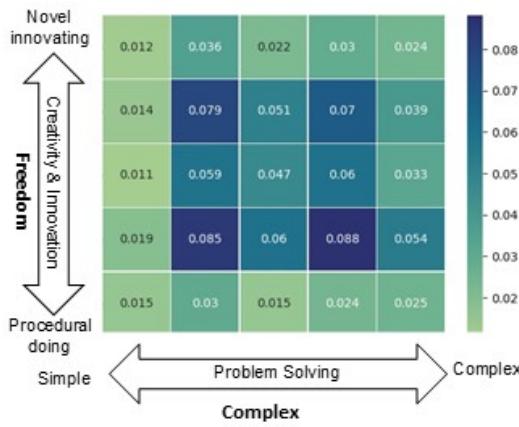
Figure 9: Problem Solving (x: Simple) Creativity and Innovation (y: Doing)
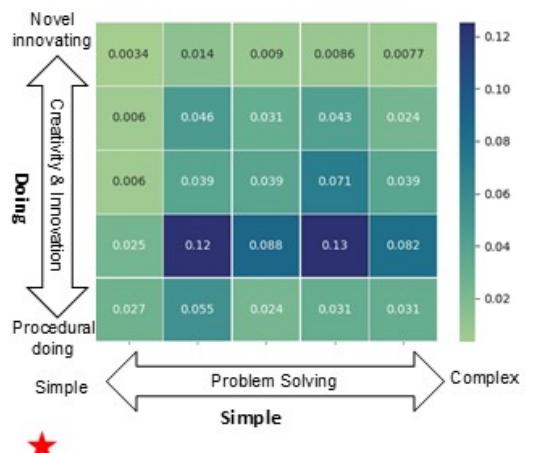
Problem Solving

Complex/less obvious solutions:
- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

Figure 10: Creativity and Innovation (x: Freedom)
Creativity and Innovation (y: Procedures)
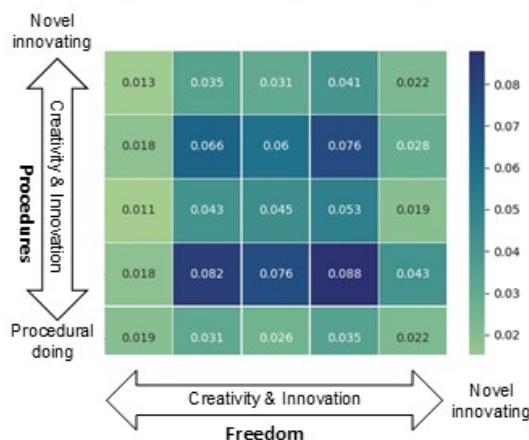
Figure 11: Problem Solving (x: Simple) Creativity and Innovation (y: Innovating)
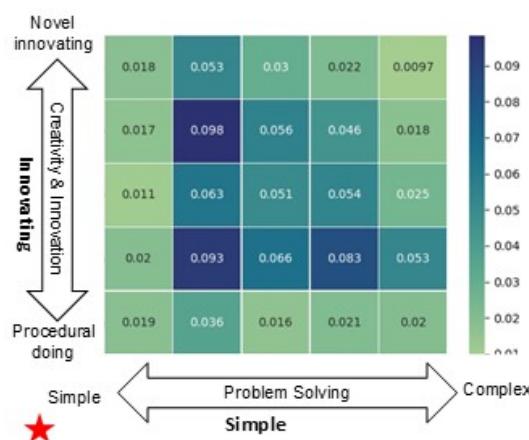
Figure 12: Problem Solving (x: Complex) Creativity and Innovation (y: Innovating)

Creativity and Innovation

Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

Problem Solving

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

**Complex/less obvious solutions:**
- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

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Figure 13: Problem Solving (x: Complex) Problem Solving (y: Simple)

Creativity and Innovation

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines
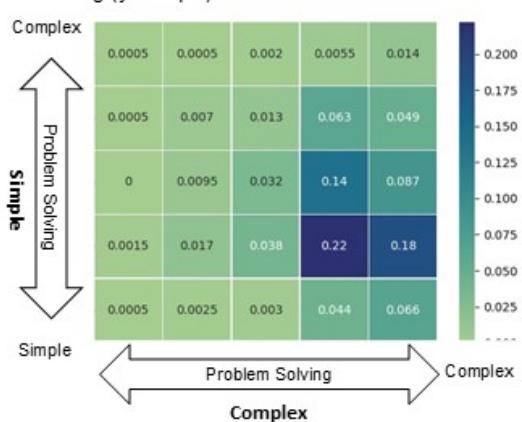
Figure 14: Problem Solving (x: Simple) Creativity and Innovation (y: Procedures)

Problem Solving

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

Complex/less obvious solutions:
- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

Figure 15: Problem Solving (x: Complex) Creativity and Innovation (y: Procedures)

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Figure 16: Decision Making (x: Fast) C&I (y: Doing)
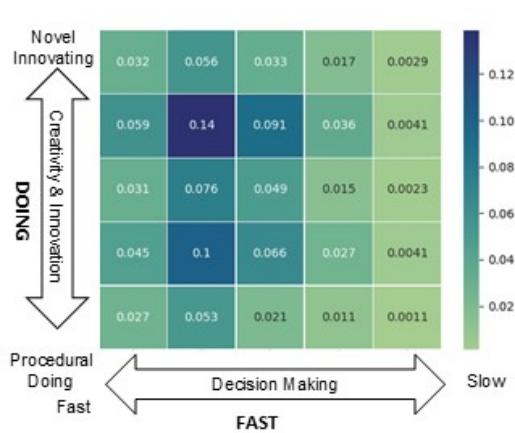
Creativity and Innovation

Doing Statements:
- Routines and Processes are essential in this environment
- I have clear tasks that I execute on a daily/weekly basis
- My working day/week is made up of stable routines
- Our processes are well established

Figure 17: Decision Making (x: Fast) C&I (y: Freedom)
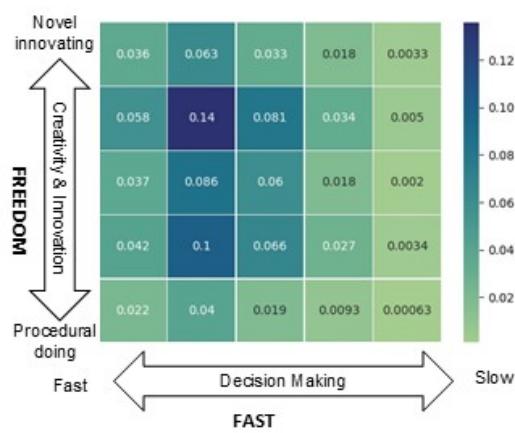
Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

Figure 18: Decision Making (x: Fast) C&I (y: Doing)

Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Slow Decision Making
- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role

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Figure 19: Decision Making (x: slow) C&I (y: innovating)
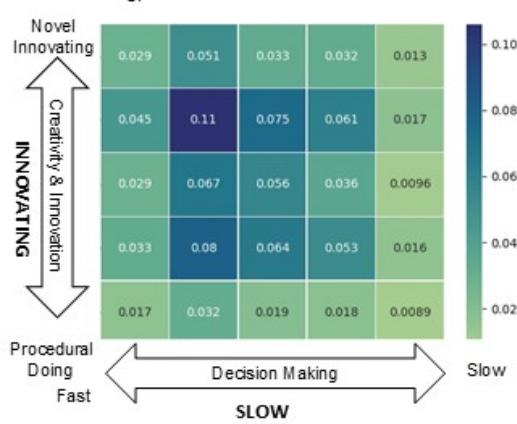
Creativity and Innovation

Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Figure 20: Decision Making (x: Fast) C&I (y: innovating)
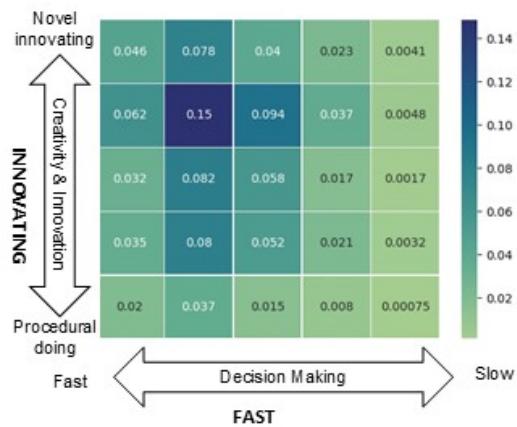
Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Figure 21: Decision Making (x: slow) C&I (y: freedom)

Slow Decision Making
- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role

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Figure 22: Decision Making (x: slow) C&I (y: Procedures)
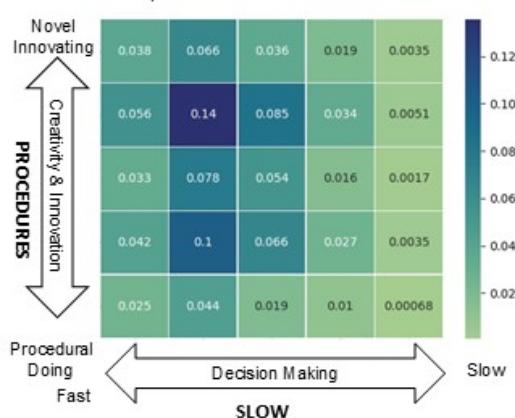
Creativity and Innovation

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Figure 23: Decision Making (x: Fast) C&I (y: Procedures)
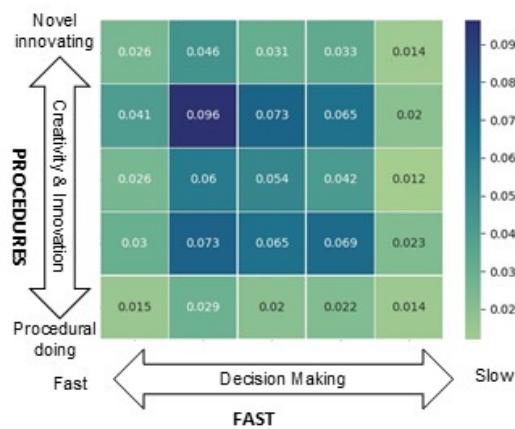
Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Figure 24: Decision Making (x: fast) Decision Making (y: slow)
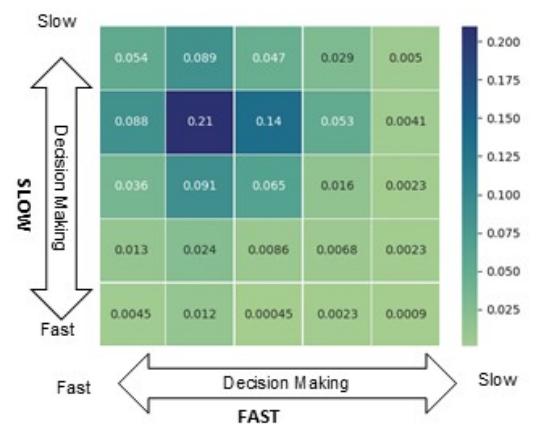
Slow Decision Making
- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role

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Figure 25: Problem Solving (x: Complex y: Simple)
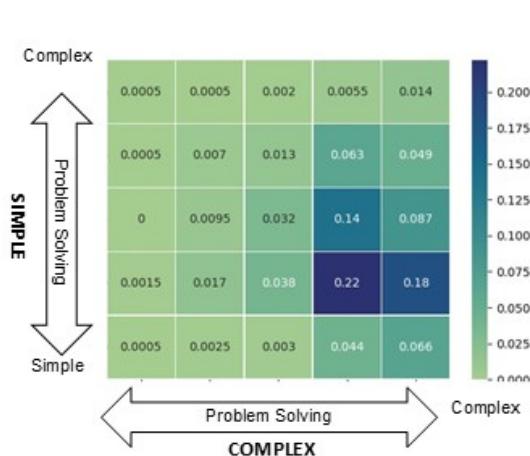
Problem Solving

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

Complex/less obvious solutions:
- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

Figure 26: Decision Making (x: Slow) Problem Solving (y: Simple)

Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Figure 27: Decision Making (x: Fast) Problem Solving (y: Complex)

Slow Decision Making
- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role

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Figure 28: C&I (x: Innovating) D&I (y: Confidence)
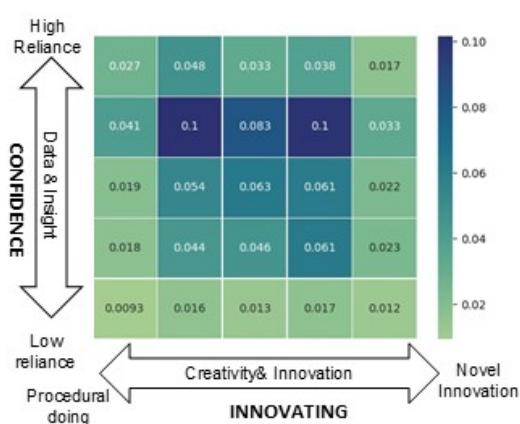
Figure 29: C&I (x: Freedom) D&I (y: Confidence)
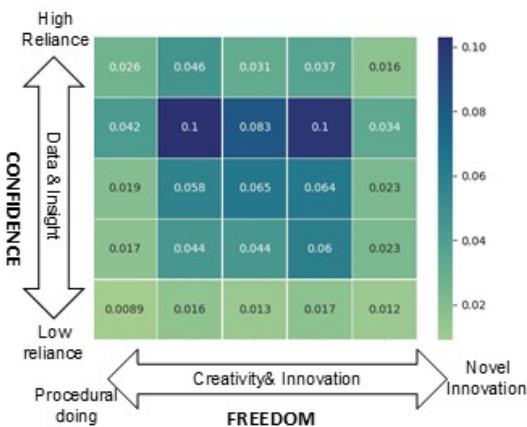
Figure 30: C&I (x: Fast) D&I (y: Confidence)
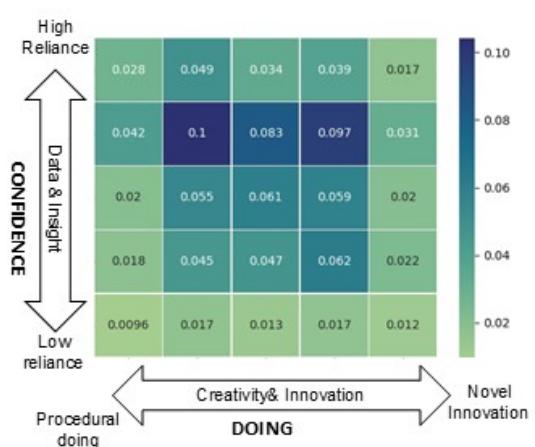
Creativity and Innovation

Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

Doing Statements:
- Routines and Processes are essential in this environment
- I have clear tasks that I execute on a daily/weekly basis
- My working day/week is made up of stable routines
- Our processes are well established

Data & Insight

Confidence
- I have a full understanding of what the data is telling me
- The data I have is the right data
- I am confident that the data we collect is the data we need

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Figure 31: C&I (x: Procedures) D&I (y: Confidence)
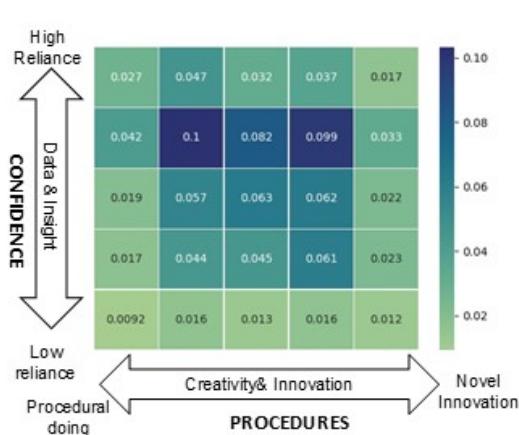
Creativity and Innovation

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Figure 32: D&I (x: Forecasting; y: Confidence)
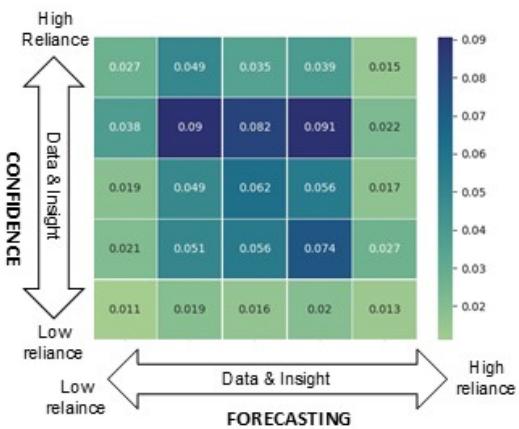
Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Figure 33: Decision Making (x: Fast) D&I (y: Confidence)
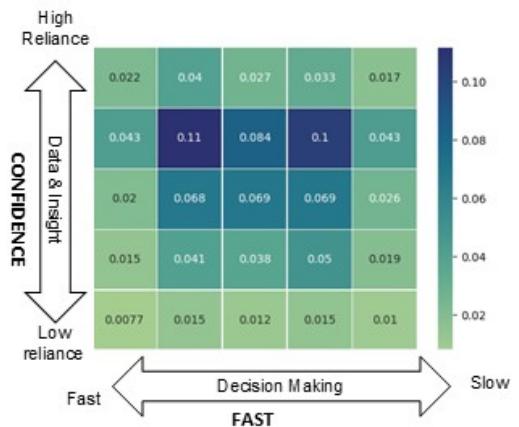
Data & Insight

Confidence
- I have a full understanding of what the data is telling me
- The data I have is the right data
- I am confident that the data we collect is the data we need

Forecasting/Predicting
- Data drives my decision making
- I predict what to do next based on the data I generate
- I use data to forecast what is going to happen

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**Figure** 34: Decision Making (x: Slow) D&I (y: Confidence)

Decision Making

Slow Decision Making
- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role
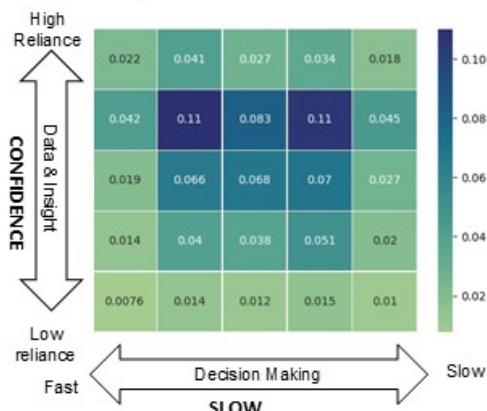
Figure 35: Problem Solving (x: Simple); D&I (y: Confidence)

Data & Insight

Confidence
- I have a full understanding of what the data is telling me
- The data I have is the right data
- I am confident that the data we collect is the data we need

Problem Solving

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

Complex/less obvious solutions:
- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

Figure 36: Problem Solving (x: Complex); D&I (y: Confidence)

Figure 37: Creativity & Innovation (x: Doing) D&I (y: Confidence)
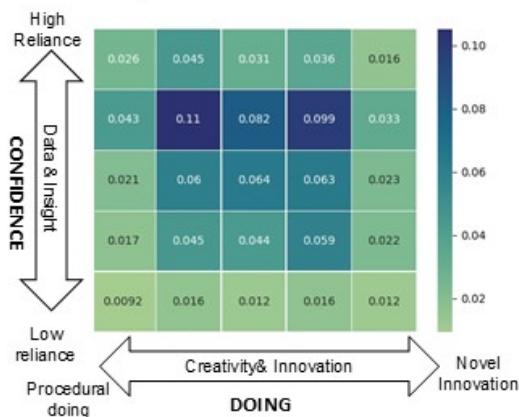
Data & Insight

Confidence
- I have a full understanding of what the data is telling me
- The data I have is the right data
- I am confident that the data we collect is the data we need

Figure 38: Creativity & Innovation (x: Innovating) D&I (y: Confidence)
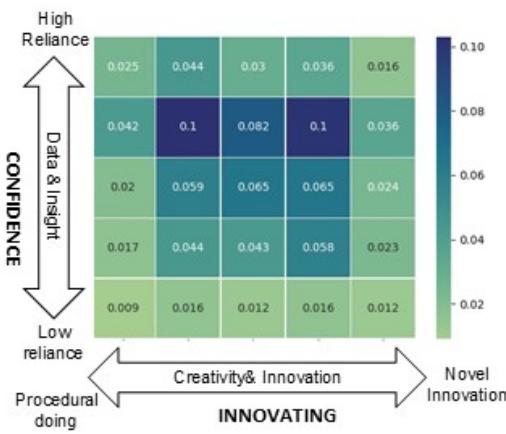
# Creativity and Innovation

Doing Statements:
- Routines and Processes are essential in this environment
- I have clear tasks that I execute on a daily/weekly basis
- My working day/week is made up of stable routines
- Our processes are well established

Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Figure 39: Creativity & Innovation (x: Freedom) D&I (y: Confidence)

Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

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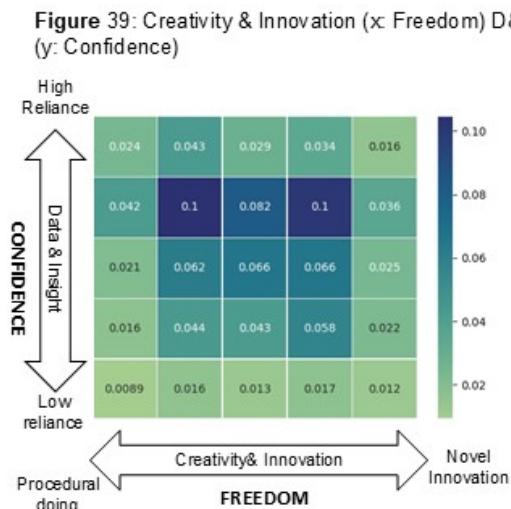
Figure 40: Creativity & Innovation (x: Procedures)
D&I (y: Forecasting)
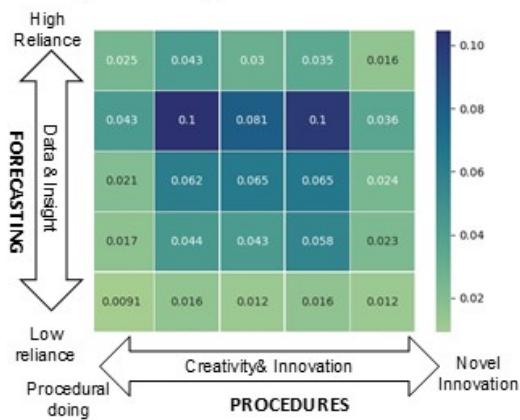
Figure 41: Decision Making(x: Slow) D&I (y: Forecasting)
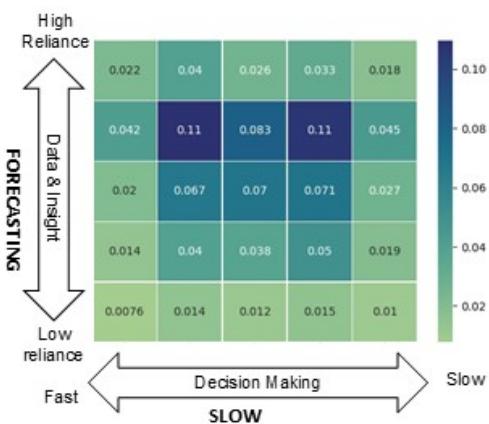
Figure 42: Decision Making(x: Fast) D&I (y: Forecasting)
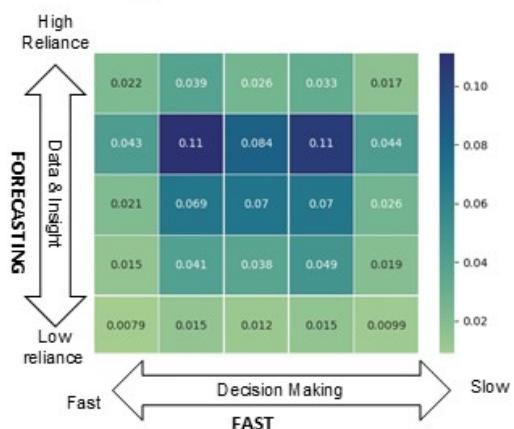
Data & Insight

Forecasting/Predicting
- Data drives my decision making
- I predict what to do next based on the data I generate
- I use data to forecast what is going to happen

Creativity and Innovation

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Slow Decision Making
- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role

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Figure 43: Creativity & Innovation (x: Doing) D&I (y: Sensemaking)
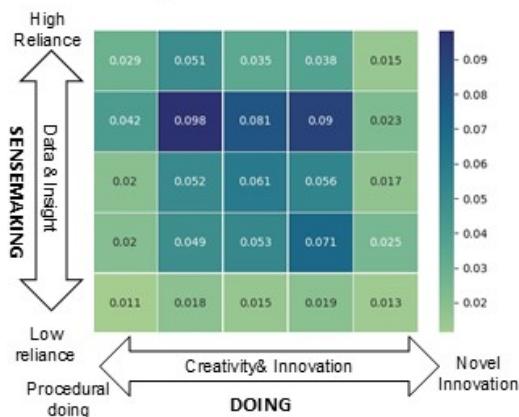
Figure 44: Problem Solving (x: Simple) D&I (y: Forecasting)
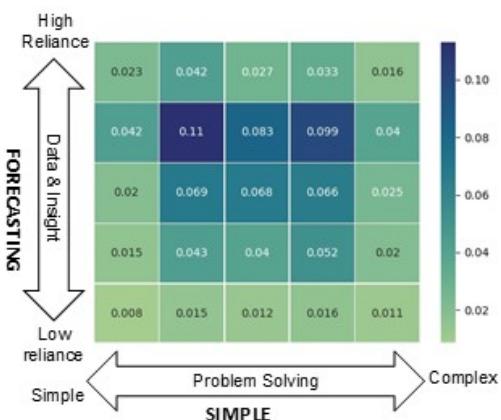
Figure 45: Problem Solving (x: Complex) D&I (y: Forecasting)
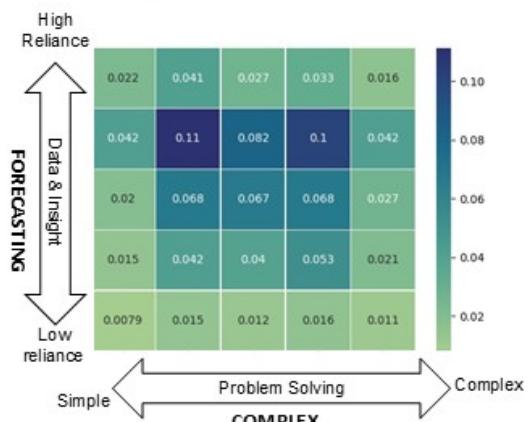
Data & Insight

Forecasting/Predicting
- Data drives my decision making
- I predict what to do next based on the data I generate
- I use data to forecast what is going to happen

Sensemaking
- I use data to understand the impact of my work
- I visualise the data to generate insight for the team
- Generating data through various means enables me to make sense of my work
- I assess data objectively and it fully informs my decision making

Creativity and Innovation

Doing Statements:
- Routines and Processes are essential in this environment
- I have clear tasks that I execute on a daily/weekly basis
- My working day/week is made up of stable routines
- Our processes are well established

Problem Solving

Tamp Simple problem Statements
- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

Complex/less obvious solutions:
- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

Figure 46: Creativity & Innovation (x: Freedom) D&I (y: Sensemaking)
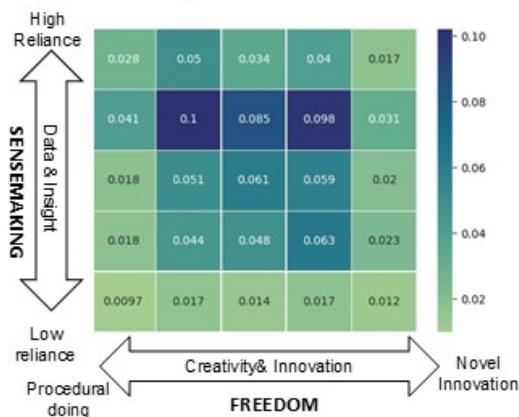
Data & Insight

Sensemaking
- I use data to understand the impact of my work
- I visualise the data to generate insight for the team
- Generating data through various means enables me to make sense of my work
- I assess data objectively and it fully informs my decision making

Figure 47: Creativity & Innovation (x: Procedures) D&I (y: Sensemaking)

Creativity and Innovation

Innovating Statements:
- I love thinking 'out of the box' and testing my ideas
- I frequently embrace new technologies when delivering in my role
- I frequently must find new solutions to be effective
- I try new things even if I am not confident it will be effective

Procedures Statements
- I have clear tasks that I execute on a daily/weekly basis
- Our processes are well established
- My delivery is measured objectively
- My working day/week is made up of stable routines

Figure 48: Creativity & Innovation (x: Innovating) D&I (y: Sensemaking)

Freedom and Predictability Statements (predictable/routine environments are typically less innovative)
- I am free to do what I want in my role
- I contribute in new and often unpredictable ways that sit outside of my sphere of knowledge
- I frequently do things that are different or untested
- I never know what's going to happen next in my working day

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Figure 49: Data and Insight (x: Confidence; y: Sensemaking)


Data & Insight

Sensemaking
- I use data to understand the impact of my work
- I visualise the data to generate insight for the team
- Generating data through various means enables me to make sense of my work
- I assess data objectively and it fully informs my decision making

Forecasting/Predicting
- Data drives my decision making
- I predict what to do next based on the data I generate
- I use data to forecast what is going to happen

Confidence
- I have a full understanding of what the data is telling me
- The data I have is the right data
- I am confident that the data we collect is the data we need

Decision Making

Fast decision making
- Anticipation is important when performing my role
- I am constantly having to react and think on my feet
- I follow my Intuition 'going with my gut' when making decisions
- The course of action is usually clear and obvious
- I unpack the solution once I recognise what is happening

Figure 50: Data and Insight (x: Forecasting; y: Sensemaking)
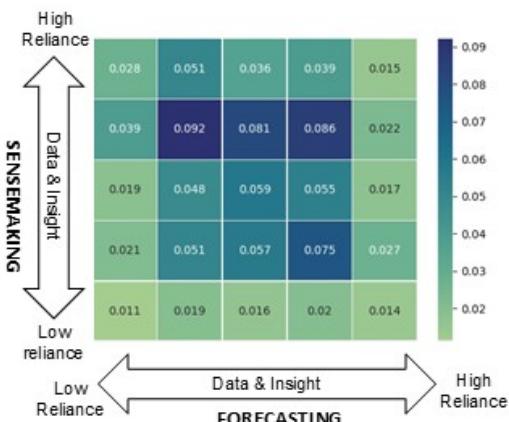
Figure 51: Decision making (x: Fast); Data and Insight (y: Sensemaking)

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Figure 52: Decision making (x: Slow); Data and Insight (y: Sensemaking)
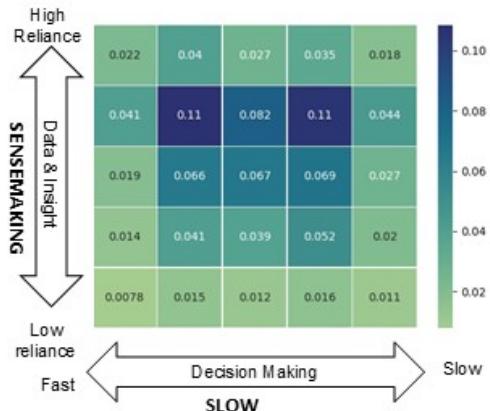
Figure 53: Problem Solving (x: Simple); Data and Insight (y: Sensemaking)
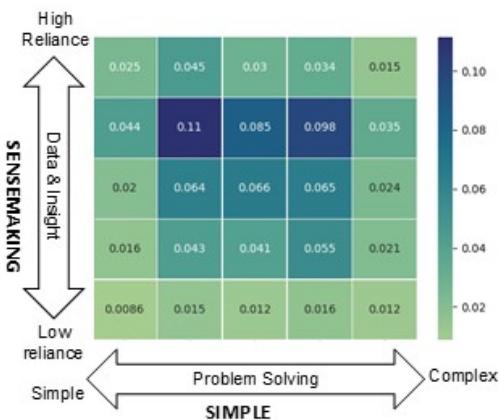
Figure 54: Problem Solving (x: Simple); Data and Insight (y: Sensemaking)
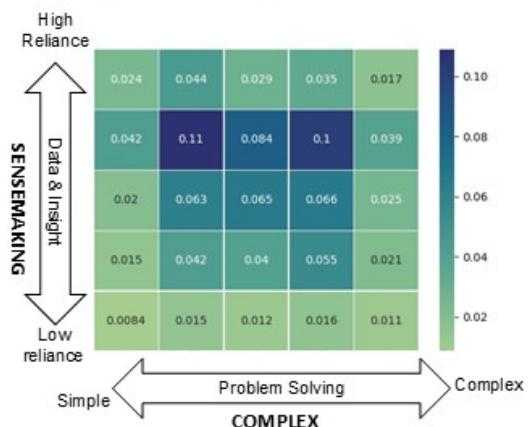
Data & Insight

Sensemaking

- I use data to understand the impact of my work
- I visualise the data to generate insight for the team
- Generating data through various means enables me to make sense of my work
- I assess data objectively and it fully informs my decision making

Decision Making

Slow Decision Making

- I frequently reason (weighing and rationalising) before making decisions
- My decisions are informed through data that has been collected
- I check my decision before moving to action
- I apply algorithms, logic and reasoning before acting in my role

Problem Solving

Tamp Simple problem Statements

- I usually have several solutions that will address the problems I work with
- Processes and checklists are important in my role
- I am confident I know what must be done to provide impactful solutions
- I have seen most scenarios that I am faced with before and am confident I can do the right thing
- The solution required when working with an athlete or team is usually obvious
- It is easy to identify problems in my role

Complex/less obvious solutions:

- I am frequently required to problem solve in my role
- I take time to establish what the problem is before addressing it
- Addressing problems is done in a methodical and considered way

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The Perspectives of how Multi-Disciplinary Teams Practitioners Work in High Performance Sport (Part 2)

Ryan King, Dr Derek McHugh, Dr John Kiley, Dr Dave Rhodes

1/2

When INNOVATING practitioners may think out of the box, test new technologies, find novel solutions and try things even if they are not confident that they will be effective.

When DOING practitioners follow routines, protocols, checklists and processes that are well established. There are clear stable tasks performed on a daily and weekly basis.

23.4% Medical
111 Practitioners
76.5% Performance
16 Disciplines

Creativity, Innovation & Problem Solving

Practitioners report being both innovators and doers
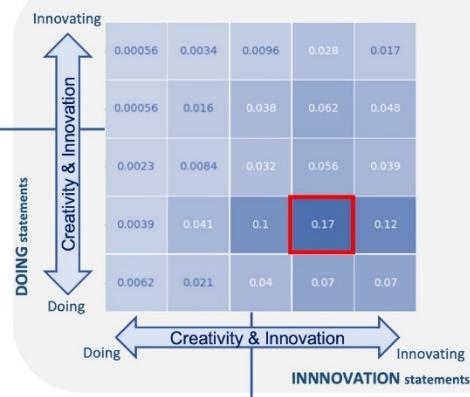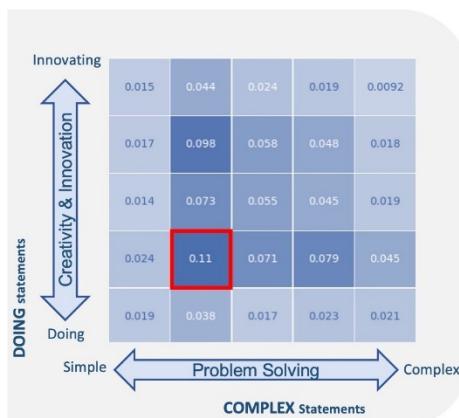
Practitioners tend to work with simple/tame problems

Practitioners deliver through Routines, Processes, Tasks & Checklists

Executing tasks through protocols and learned processes align with characteristics of intuitive expertise

Innovation is not essential when performance problems are simple
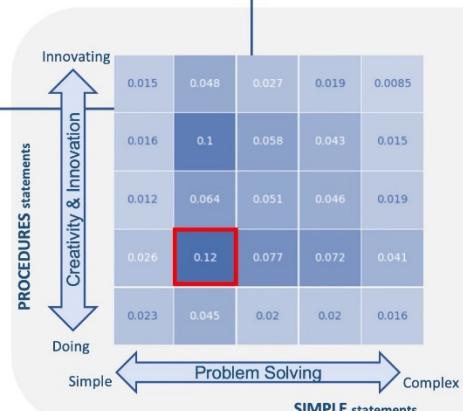
Decision Making and Problem Solving

Decision making is choosing a course of action. In dual system theory we can make Fast 'intuitive' and Slow 'logical' decisions.

Problem Solving is the process of finding solutions to difficult or complex issues. Problems can either be 'simple' or 'complex'.

What types of decision making do Multi Disciplinary Team Practitioners rely on when problem solving?

Complex	0.021	0.037	0.026	0.032	0.015
	0.034	0.079	0.065	0.074	0.023
	0.021	0.05	0.057	0.062	0.021
	0.025	0.061	0.068	0.095	0.035
Simple	0.013	0.024	0.02	0.025	0.018

SIMPLE Statements — Problem Solving

Fast ← Decision Making → Slow

SLOW Statements
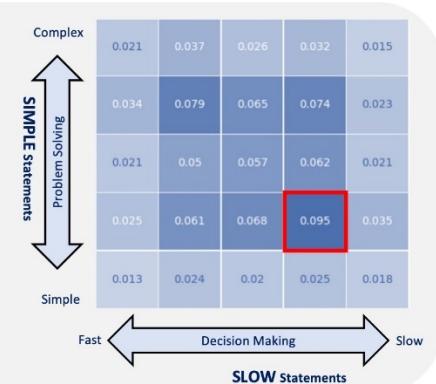
**Simple Problems, Slow Decisions,
Complex Problems, Fast Decisions.**

Complex	0.03	0.055	0.036	0.033	0.013
	0.041	0.095	0.075	0.071	0.021
	0.019	0.049	0.052	0.055	0.019
	0.023	0.055	0.059	0.082	0.03
Simple	0.011	0.021	0.018	0.022	0.015

COMPLEX Statements — Problem Solving

Fast ← Decision Making → Slow

FAST Statements
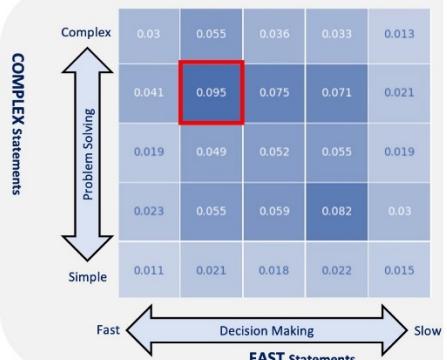
The range of responses indicates a variety of decision making and problem-solving types

How do Practitioners use data and insight?

High Reliance	0.028	0.051	0.036	0.039	0.015
	0.039	0.092	0.081	0.086	0.022
	0.019	0.048	0.059	0.055	0.017
	0.021	0.051	0.057	0.075	0.027
Low reliance	0.011	0.019	0.016	0.02	0.014

SENSEMAKING Statements — Data & Insight

Low Reliance ← Data & Insight → High Reliance

FORECASTING Statements
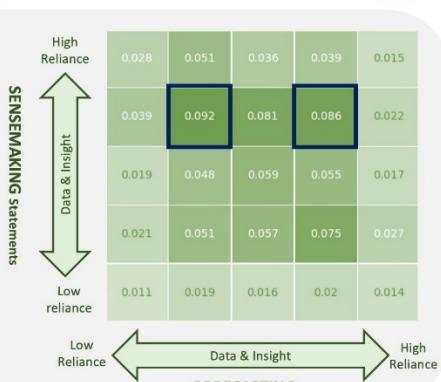
Practitioners rely on data to make sense of what has happened. It is not clear whether data is used to predict and forecast future outcomes

**Practitioners rely on data when making decisions.**

There is dissonance in how practitioners report thinking about solving problems

There is a mixed bag of perspectives on the types of problems faced by practitioners

Practitioners report making both fast and slow decision types

Practitioners rely on data to make sense of their decisions

APPENDIX F: Example MDT Practitioner Infographic

An ongoing thirst for holistic personal & interpersonal growth.

Role Clarity & Shared Understanding

Interpersonal Skills & Development

Adaptability & Contextual Awareness

Leadership & Team Dynamics

The need for effective leadership & teamwork in achieving success.

Practitioners Lens

Focus on performance & Athlete Wellbeing

Decision Making & Problem Solving

Navigating the complexities of decision-making & problem-solving in sports.

Psychological Safety & Positive Team Dynamics

Collaboration & Knowledge Sharing

Leveraging open & productive collaboration & judicious sharing.

Diversity of Skills Perspectives & Ways of Thinking

APPENDIX G: Example presentation to MDT practitioners and coaches

You all have an important contribution to make, each of you hold experiences, skills and expertise that when harnessed, can do exceptional things

Blended Intelligence

Cognitive Repertoire

- Perspectives
- Mental Models
- Knowledge
- Heuristics
- Tools

Blended Intelligence
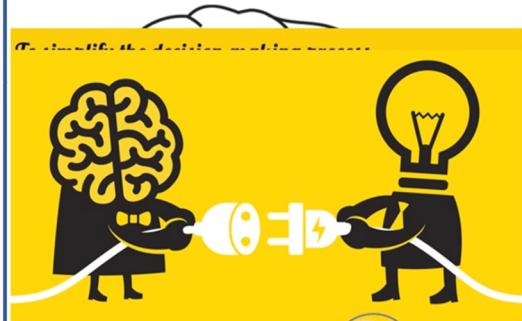
Individual Ability Vs Cognitive Diversity
Many heads are better than one… but not always!
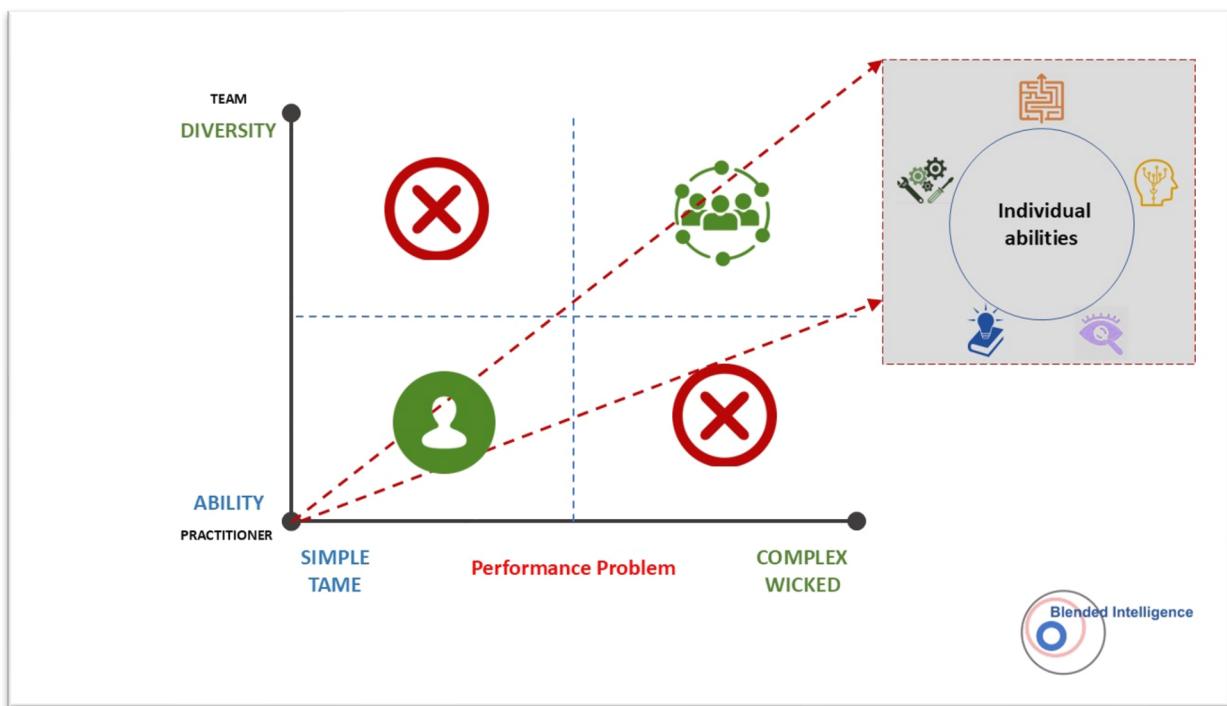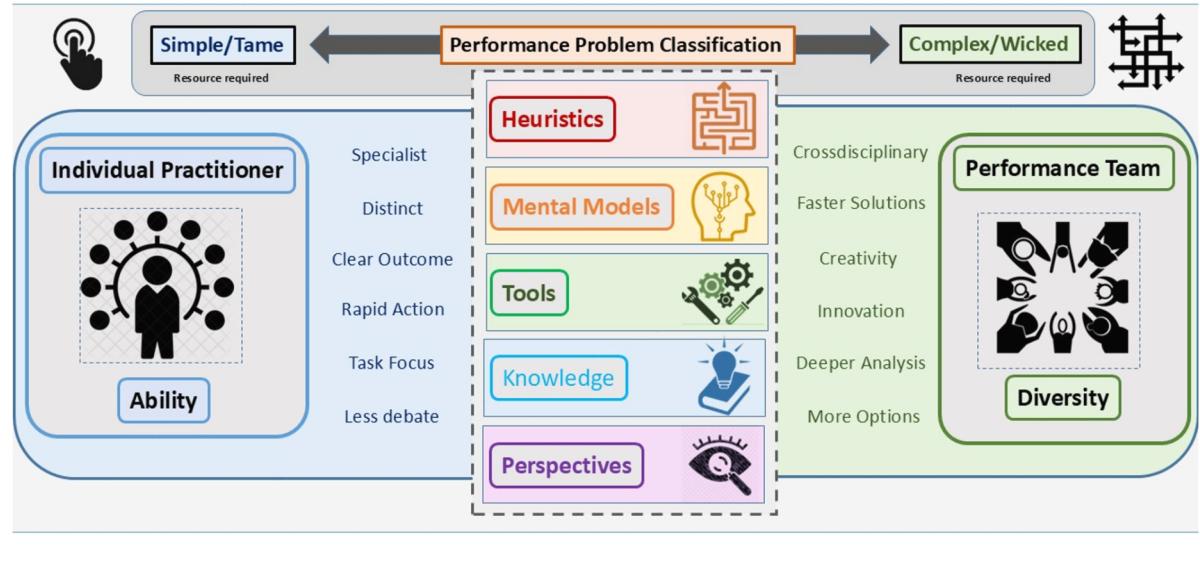
Take Home 1:

Individual ability can trump collaborative teamwork

The Puzzle Task

**You have 5 minutes to solve the puzzle on your table
Your time starts now**
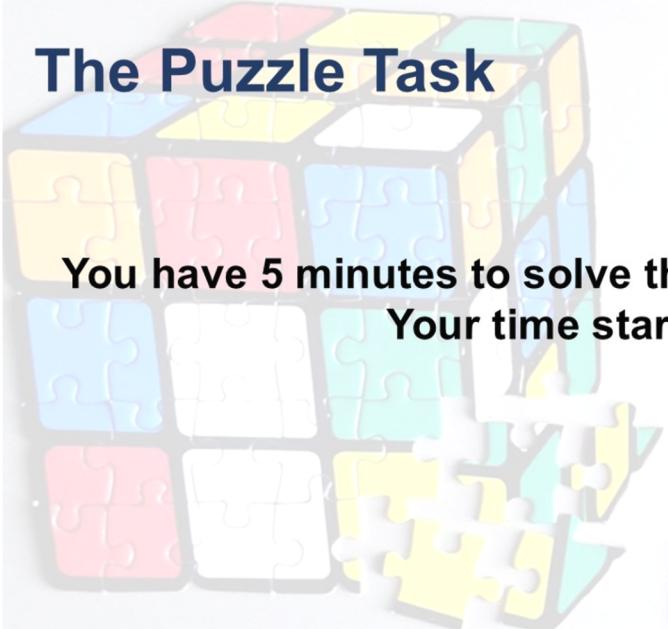
Debrief

What were the main features of this task?

As a team, how did you go about completing the task?

What were the skills that were required to deliver the task?

If you were to do the task again, how might you tackle it?
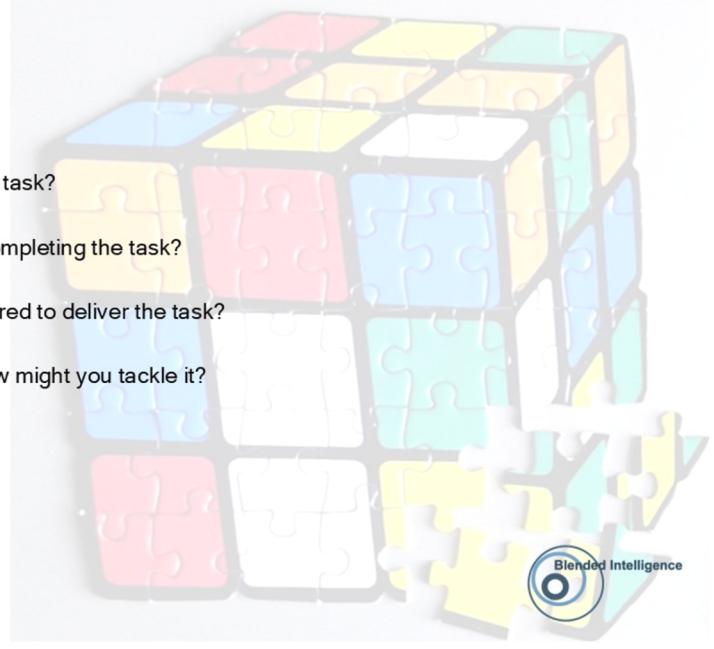
The Practitioners

S&C

Sports Science

Physio

The Solution

Corners

Edges

Fit

Take Home 2:

What we call the '*inter-professional*' team does not necessarily align with what is required or how they operate

Does this matter?

Consideration:

If we were better at discriminating between 'performance' problem types, could we more purposefully tap into the cognitive diversity available within the team

Problems are puzzles

Do **MDT's** have to solve problems?

Blended Intelligence

Task Vs Problem

A distinction can be made between "task" and "problem."

- Generally, a *task* is a well-defined piece of work.
- A *problem* is generally considered to be a task, a situation, or person which is difficult to deal with or control due to complexity and intransparency.

In everyday language, a problem is a question proposed for solution, a matter stated for examination or proof. In each case, a problem is considered to be a matter which is difficult to solve or settle, a doubtful case, or a complex task involving doubt and uncertainty.

What type of problem?

PROBLEMS

WELL-DEFINED PROBLEMS

ILL-DEFINED PROBLEMS

re-Solution 1

re-Solution 5

re-Sc

re-Solution 4

Input

WICKED PROBLEM

Blended Intelligence

VUCA problems

Blended Intelligence

	Neither problem nor solution is clear	Cognitively complex problem	Conceptually contentious problem	Very wicked problems
Increasing complexity of problems	Problem clear, solution not clear	Analytically complex problem	Complex problem	Politically turbulen problem
	Both problem and solution clear	Tame problem	Communicatively complex problem	Politically complex problem
		Co-operative or indifferent relationships	Multiple parties, each with only some of relevant knowledge	Multiple parties, conflicting in values/interests

Increasing difficulty re stakeholders/institutions

Blended Intelligence

My daily work is a process of doing?

- Repeatable
- Predictable
- Processes
- Checklists
- Procedures
- Automated

My daily work is a process of overcoming problems?

- Novelty
- Innovation
- Uncertainty
- Risk
- Volatile

Figure 1.2. The Process Knowledge Spectrum

Take Home 3:

Practitioners report working with both simple problems that require 'procedural' type solutions and complex problems demanding more considered approaches

Therefor: Cognitive flexibility is a required skill of MDT practitioners and tailored approaches are needed.

Take Home 4:

Cross-disciplinary 'collaborative' working should be used when novel solutions are required. There is a risk that 'Politically Complex' problems are generated due to a mismatch between problem type and those who are asked to be involved.

What do you see?
I'll give you 3 seconds to make up your mind

OK – what did you come up with...
The pictures are all the same but we each saw something different

What story might you tell with these images?

Recognition-Primed Decision (RPD) Model

Seeing What Others Don't
The Remarkable Ways We Gain Insights
GARY KLEIN
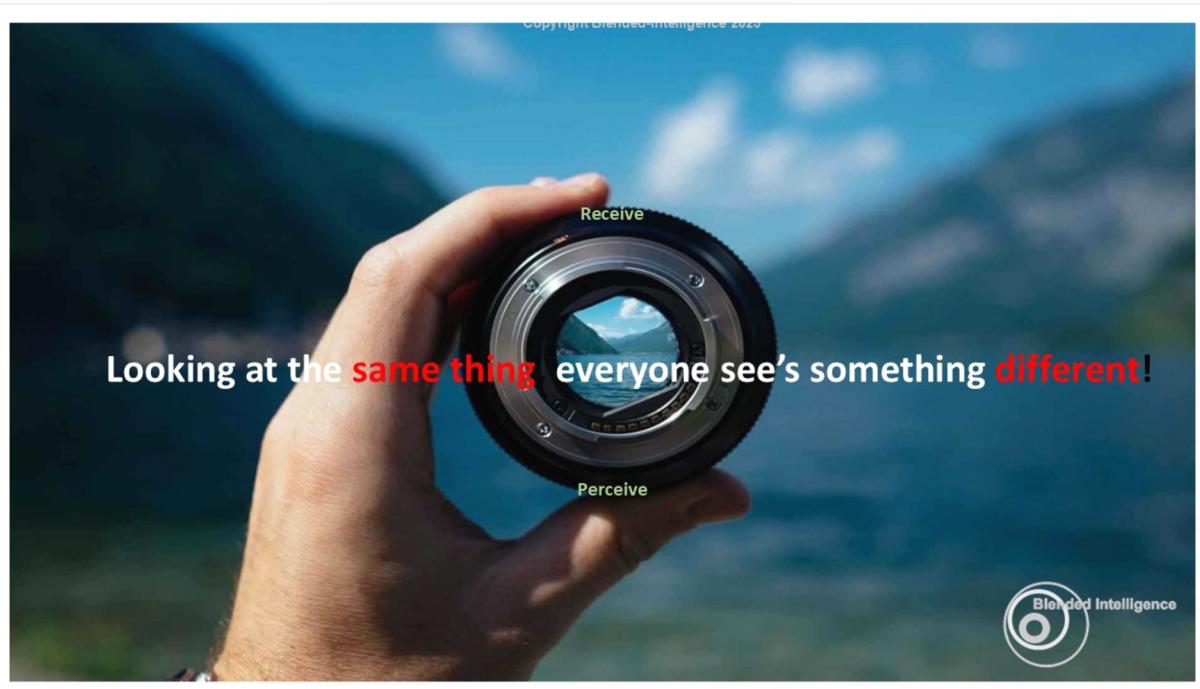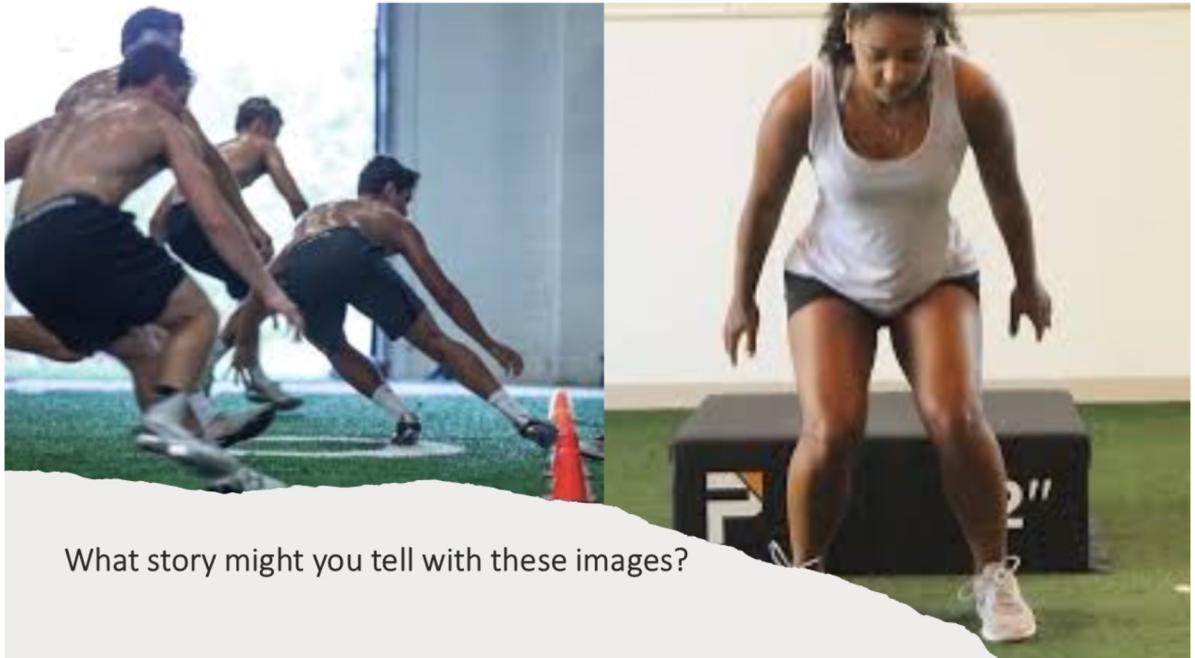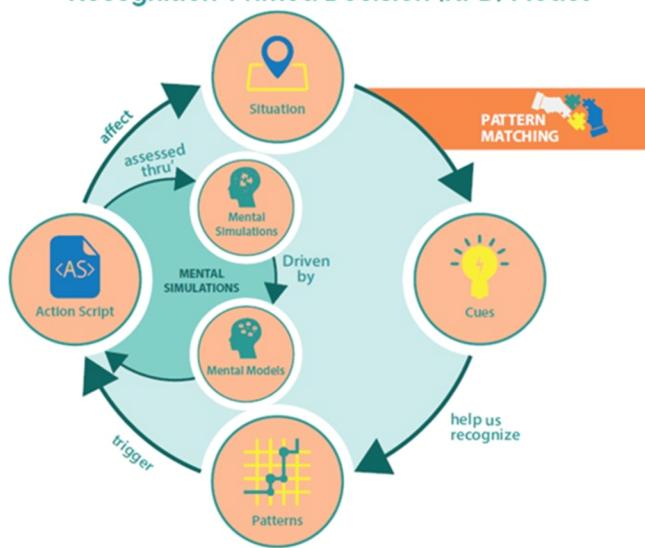
'Noone has taught me more about decision-making' Malcolm Gladwell

The Bat and Ball problem

a. 0.05
b. 0.10
c. 1.00
d. 0.50

Thinking,
fast
and slow

DANIEL
KAHNEMAN

NOBEL LAUREATE IN ECONOMICS

'Certainly the most important
psychologist alive today'
STEVEN PINKER
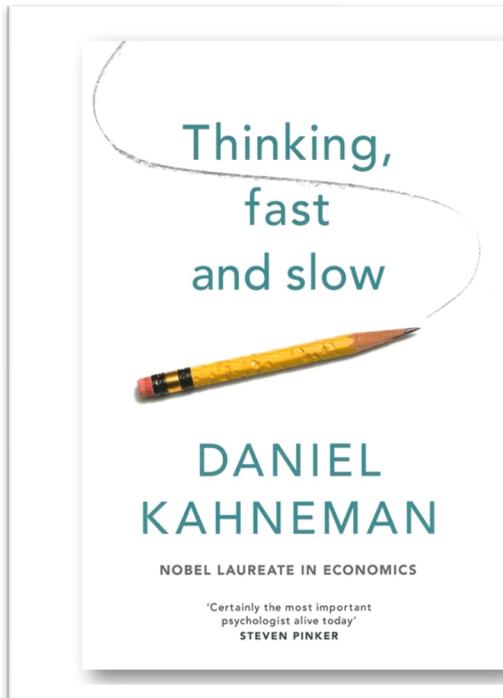
SYSTEM 1
Intuition & instinct

95%

Unconscious
Fast
Associative
Automatic pilot

SYSTEM 2
Rational thinking

5%

Takes effort
Slow
Logical
Lazy
Indecisive
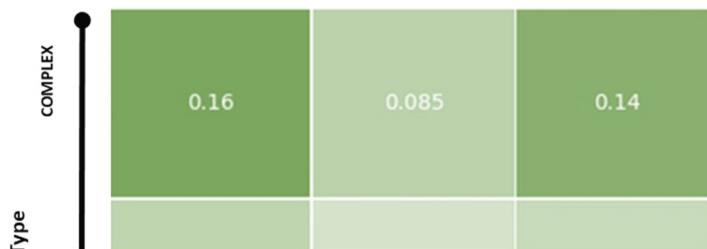
Source: Daniel Kahneman

Blended Intelligence

Take Home 5:

Practitioners report making fast 'intuitive' decisions attending to simple problems.

This suggests that intuition is a feature of elite high-performance practitioners' expertise

Consideration

Are we good at detangling problems from decisions and do we recognise that they are different things?

Problem Solving Type	Tame/Simple ●————————————————————————● Wicked/Complex		
	These are problems where solutions are clear and well-defined, often with established methods or routines for addressing them. The challenges are predictable and manageable through systematic procedures. The environment is stable, and tasks are repetitive or routine, relying heavily on established processes and expertise.		**These involve issues that are ambiguous and multifaceted, often lacking clear solutions. The nature of these problems is dynamic and evolving, requiring innovative and adaptive approaches. Solutions are not straightforward and may involve complex interactions and uncertainties. Such problems often require creative thinking and flexible strategies.**

Problem Solving Type (PST)

Tame/Simple ●————————————————————————● Wicked/Complex

These are problems where solutions are clear and well-defined, often with established methods or routines for addressing them. The challenges are predictable and manageable through systematic procedures. The environment is stable, and tasks are repetitive or routine, relying heavily on established processes and expertise.

These involve issues that are ambiguous and multifaceted, often lacking clear solutions. The nature of these problems is dynamic and evolving, requiring innovative and adaptive approaches. Solutions are not straightforward and may involve complex interactions and uncertainties. Such problems often require creative thinking and flexible strategies.

Problem Solving Approach (PSA)

Procedural ●————————————————————————● Creative

This approach involves following established methods, procedures, or protocols to address problems. It is characterised by reliance on systematic processes, routine tasks, and structured approaches. The focus is on applying known techniques and guidelines to achieve solutions efficiently and consistently.

This approach emphasises innovation, experimentation, and exploration of new ideas or methods. It involves thinking outside traditional frameworks and applying novel or unconventional solutions to challenges. Creative problem solving values adaptability and originality in addressing complex or unique issues.

Decision Making Approach (DMA)

Fast ●————————————————————————● Slow

This approach relies on quick judgments based on experience, intuition, or gut feeling, sometimes referred to as intuitive expertise. Decisions are made rapidly without extensive analysis or deliberation. It often involves relying on heuristics or instinctive responses to address immediate needs or uncertainties.

This approach involves a deliberate and methodical process for making decisions. It emphasises thorough analysis, data evaluation, and logical reasoning before reaching conclusions. Decisions are made after careful consideration of various factors and potential outcomes, often involving extensive information and structured evaluation.

King, R., McHugh, D., Alexander, J., Kiely, J., Yiannaki, C., & Rhodes, D. (2024). Multidisciplinary Team Practitioners Working in High Performance Sport: Skilled Intuitive 'Doers' or Novel Problem-Solving Innovators. European Journal of Sport Sciences. 3(2). 15–26.

Problem Solving Type

Tame/Simple ●————————————————————————● Wicked/Complex

38%   23%   39%

Problem Solving Approach

Procedural		Creative	Procedural		Creative	Procedural		Creative
●———		———●	●———		———●	●———		———●
37%	21%	41%	36%	25%	39%	37%	21%	42%

Decision Making Approach

Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow
37%	40%	34%	38%	38%	41%	34%	38%	32%	37%	33%	38%	37%	41%	34%	39%	36%	42%
23%		28%		23%		28%		31%		28%		22%		27%		22%	

King, R., McHugh, D., Alexander, J., Kiely, J., Yiannaki, C., & Rhodes, D. (2024). Multidisciplinary Team Practitioners Working in High Performance Sport: Skilled Intuitive 'Doers' or Novel Problem-Solving Innovators. European Journal of Sport Sciences, 3(2), 15–26. https://doi.org/10.24018/ejsport.2024.3.2.143

King, R. (2025) Problem Solving Framework

- **Clearer roles in RTP decisions** - improve communication and decision-making.
- **Enhanced problem-solving** - more integrated, team-based approach.
- **Efficient collaboration on performance challenges** - load management, recovery, and balancing athlete development with competition demands.
- **Establishing a consistent approach across all performance sports** - while allowing flexibility to meet the unique needs of each sport.

Sticky Ideas… (the summary)

As an individual
- Are the problems you work with well or ill-defined?
- Do you deliver through processes; procedure and checklists or are you required to innovate and find novel solutions?
- Are you making 'fast intuitive' or 'slow rational' decisions?

As a team
- Is it about 'you or us', 'I or we'? Individual ability Vs cognitive diversity? Each has a place.
- Is the team set up to effectively identify and solve problems?
- What type of inter-professional team is required?
- Communication, Cooperation and coordination Vs Collaboration

---

When is collaboration is required

Are you a problem solvers or a doer?

Do you seek out perspectives?

Do you share your ideas and contribute to the teams processes?

Questions or Feedback:

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